Ecological Guide to Mixed Conifer Plant Associations

Northern Sierra Nevada and Southern Cascades: Lassen, Plumas, Tahoe, and Eldorado National Forests

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- Douglas-fir -mixed conifer/Sierra laurel

Introduction

This field guide is a condensed version of the more detailed desk guide. It is designed for ease in field identification and reference to key management information. For more detail refer to the complete desk guide.

The key is designed for use in stands greater than 70 years old. The Eldorado, Tahoe, Plumas and Lassen National Forests were sampled to develop this guide. Coordination with ecologists on other forests was undertaken to develop series keys that are consistent across Forest Boundaries. This classification represents much field work and analysis, and is considered "final". However, as we continue to learn more about the ecosystems of the Sierra Nevada and southern Cascades, the classification may be modified to incorporate new useful information. The guide is published in a loose-leaf binder format to facilitate incorporation of new information.

The plant associations that occur within the mixed conifer zone on the west-side of the northern Sierra Nevada and the southern Cascades are the emphasis of this guide.

Classification Concepts

This classification is based upon the concept of potential natural vegetation. The potential natural vegetation for a site, is the assemblage of plant species that would occur following an extended period of time without major disturbance (i.e. stand replacing or understory fire, timber harvest). This concept is useful in classifying the environmental variation that results in different capacities of plant species to occur and respond to management. It is not necessary for a site to be undisturbed for a long period of time to classify into a plant association. The presence and amount of indicator species are used to distinguish among the plant associations. Plants are chosen as indicators for their fidelity with individual or combined environmental factors or for their predictive capacity for vegetation response to management. Plants that are associated primarily with disturbance, are considered disturbance indicators and are generally not used as plant association indicators.

A hierarchical scheme is used here for the classification including series, plant association group, and plant association categories. Plant associations, the primary level in the classification hierarchy, refer to a "potential natural plant community of definite floristic composition and uniform appearance" (FSM 2090, 1990). Series, the highest level in the hierarchy, refers to an aggregation of taxonomically related plant associations that takes the names of the climax species that dominate or have the potential to dominate the principle layers. Plant association groups refer to plant associations with shared ecological characteristics that affect management.

Vegetation Overview

Forests cover the majority of National Forest Land in the northern Sierra Nevada and southern Cascades. At least seventeen different forested series occur, including thirteen conifer series and four hardwood series. At higher elevations, wet areas and east of the mountain crest, substantial areas of non-forested vegetation occur, dominated by shrubs or herbs.

Changes in the forested series are evident with increasing elevation. At the lowest elevations, generally below 3,000 feet, the ponderosa pine, Douglas-fir, and canyon live oak series are found. Ponderosa pine occurs on southerly aspects and ridges, while Douglas-fir occurs on northerly aspects or in drainages. Canyon live oak is found on rocky sites throughout this elevational band and higher in the mixed conifer zone, especially in large canyons where shallow soils occur on steep slopes.

Above 3,000 to 4,000 feet, the mixed conifer zone occurs. At least three complexly overlapping series occur within the mixed conifer zone. These series include the Douglas-fir -mixed conifer series, the ponderosa pine-mixed conifer series, and the white fir-mixed conifer series. At higher elevations, usually above 5,000 feet, the white fir series begins to intergrade with the mixed conifer zone. The Jeffrey pine series occurs at the same elevations as white fir and higher up into the red fir zone on rocky or eastside sites. At about 6,000 feet, the red fir, lodgepole pine and western white pine series occur. The mountain hemlock series generally occurs above 7,000-8,000 feet, in areas of heavy snow accumulation. Whitebark pine occurs in limited locations, generally above 8,000 feet.

In wetter areas, generally riparian or wetland, several harwood dominated series are found. At lower and mid-elevations, the black cottonwood and white alder series occur. The quaking aspen series occurs at higher elevations.

Using This Guide

Species Identification and Naming Conventions

Scientific names follow Hickman (1993) for most plants. For a few sensitive plants the scientific names follow Munz (1968). Common names and codes are used in the descriptions for plants. The common names are from Hickman (1993), Weedens (1986), and Hitchock and Cronquist (1973). The codes are four letters and sometimes a number. These codes are from the Soil Conservation Service (SCS) Automated Data Processing (ADP) guide, with the first two letters representing the first two letters of the genus and the second two letters from the first letters of the species. An example is PIPO, for *Pinus ponderosa*. The code "MCN" refers to mixed conifer.

The plant association names are generally referred to by codes in the text and tables to save space. The names are based upon the major climax tree species and the most indicative shrubs or herbs. A slash ,"/", separates life forms (i.e. trees/shrubs/herbs) in the plant association names, while a dash, "-", separates members of the same life form.

Several taxa sampled are not clearly separable. *Galium bolanderi* is often variable and sometimes the distinction between *G. bolanderi* and *Galium sparsiflorum* is not clear. Some of the *G. bolanderi* listed may actually be *G. sparsiflorum* especially on cooler, moister sites. Recent, more careful examination of *Carex* species in this zone have indicated that at least some of the *Carex* identified as *C. rossii* may be *C. brainerdii* (Janeway 1992, pers. comm.).

Plant Association Descriptions and Summary Tables

The summary tables include constancy ("CON") and mean cover. Constancy refers to the percentage of the plots in which the plant occured. For example, a constancy of 40% refers to the presence of the plant in 40% of the plots in the type. Canopy covers were estimated separately by species and separately by layer, representing absolute covers. In the tables, these measured absolute covers were averaged for only those plots where the plants occurred. This is relative cover.

Management Interpetations

Management interpretations for individual plant associations and plant association groups were developed by interdisciplinary teams on the Eldorado, Tahoe, Plumas and Lassen National Forests. A representative location for each plant association was visited in the field by teams comprised of silviculturists, wildlife biologists, soil scientists, fuels specialists, botanists, and range conservationists. The management interpretations developed by these teams included more information than is possible to include in a condensed field guide. For more complete information see the desktop guide. After the interdisciplinary teams provided their input on management interpretations, the interpretations were sent to all of the Districts and Supervisors' Offices in the Zone for further review. It is expected that with future use of the classification guide that additional or refined management interpretations will be developed. Therefore, the management interpretations presented here should be considered preliminary.

Keys to Plant Associations

Variation in vegetation across the landscape is often continous. A classification of vegetation in the landscape, plant associations, is useful for interpreting and managing landscapes. The plant associations are abstractions based upon plot data taken throughout the mixed conifer zone. Plots were grouped according to plant community similarity and used as the basis for an abstraction process. Few stands will exactly conform to descriptions of average stands in the association descriptions. Although sampling was conducted in a systematic manner, there are many ecotonal areas (transitional between two plant associations) that will not fit neatly into any particular plant association. Such areas should be managed according to the characteristics of the associations between which they fall. In many cases, floristically similar associations have similar management properties.

Steps to Using the Keys

1. Select a vegetatively and topographically uniform area.

2. Identify and list trees, and indicator shrub and herb species, and estimate the percent cover of each. (Cover is estimated to the nearest percent up to 10 percent and to the nearest 5 percent thereafter).

3. Work through series and association keys (step by step, not skipping couplets).

4. Review association description to verify the identification. The key is a tool to classify most sites but *association descriptions should be reviewed to assure proper identification.*

5. If the key doesn't seem to fit:

    A. Re-evaluate your choice of series.

    B. Closed canopy stands may have sparse or absent shrub and herb layers. If this seems to be true, then re-use the key but reduce covers necessary by half. It is also useful to compare an adjacent older or undisturbed stand with the same environment, with a better developed understory.

Series Key*

1. Non-forest vegetation, shrub and/or herb dominated. Site does not have the potential to produce trees NON-FOREST COMMUNITIES
1. Trees comprise at least 10% canopy cover 2

2. Hardwoods dominate the canopy and regeneration layers. <10% conifer in canopy or <2% in regeneration layers . . . HARDWOOD SERIES
2. >10% conifer cover in canopy or >2% in regeneration 3

3. Regeneration layer predominately ponderosa pine or Jeffrey pine . . . . . JEFFREY PINE or PONDEROSA PINE SERIES
3. Not as above 4

4. Pure lodgepole pine, regeneration of other species <1% . . . . . LODGEPOLE PINE SERIES
4. Not as above 5

5. Regeneration layer predominately Douglas-fir. Regeneration of other species (white fir, incense cedar, ponderosa pine, Jeffrey pine) < 2% . . . . . DOUGLAS-FIR SERIES
5. Not as above 6

6. Regeneration layer predominately mountain hemlock . . . . . MOUNTAIN HEMLOCK SERIES
6. Red fir >10%. <20% white fir or <10% montane species (Douglas-fir, ponderosa pine, incense cedar) . . . . . RED FIR SERIES
6. Not as above 7

7. Regeneration layer co-dominated by at least two conifer species (white fir, incense cedar, ponderosa pine, Jeffrey pine, Douglas-fir) 8
7. Not as above 9

8. White fir-ponderosa pine or white fir-Jeffrey pine co-dominate regeneration layers. >2% ponderosa pine regeneration. Eastside habitat WHITE FIR-PONDEROSA PINE SERIES or SUBSERIES
8. Canopy layer comprised of at least 2 (usually 3) conifer species and 2 or more species regenerating. Incense cedar typically >5% in overstory or >2% in regeneration . . MIXED CONIFER SERIES GROUP

* Subject to change with inter- and intra-regional classification coordination.

9. Regeneration dominated by white fir, incense cedar <2% regen. . . . . WHITE FIR SERIES
9. Dense canopy (especially lodgepole pine or knobcone pine). Go back to step 4 and use relative covers or dominance of shade tolerant species.

Notes

Key to Plant Associations in the Mixed Conifer Series Group

1. Deciduous riparian hardwoods (white alder,black cottonwood, aspen,mountain alder) >5% . . OBLIGATE RIPARIAN GROUP
1. Not as above 2

2. Big-leaf maple >10% . . . . . BIG-LEAF MAPLE GROUP
2. Not as above 3

3. Canyon live oak > 10% . . . . . CANYON LIVE OAK GROUP
3. Not as above 4

4. Mountain dogwood > 20% . . MOUNTAIN DOGWOOD GROUP
4. Not as above 5

5. Tanoak > 10% . . . . . TANOAK GROUP
5. Not as above 6

6. Evergreen shrubs, bush chinquapin, huckleberry oak or Sierra laurel >10% . . . . . EVERGREEN SHRUB GROUP
6. Not as above 7

7. Bearclover > 10% . . . . . BEARCLOVER GROUP
7. Not as above 8

8. One or more of the following shrubs present at the stated cover: hazelnut >5%, snowberry >1%, or serviceberry >1% DRY, MOIST, MODERATE GROUPS KEY
8. Not as above 9

9. No indicator shrubs present, herbs dominate an often sparse understory . . . . DRY, MOIST, MODERATE GROUPS KEY
9. Understory nearly absent, no indicator species present. Shaded, return to step 1 and use relative cover.

Big-Leaf Maple Group Key

1. Tanoak > 10%, and hazelnut > 5% . PSME-MCN-LIDE2/COCOC
1. Not as above, tanoak absent or minor PSME-MCN-ACMA/ADBI

Bearclover Group

1. Canyon live oak > 10% PIPO-MCN-QUCH2/CHFO2
1. Canyon live oak minor or absent 2

2. Tanoak > 10% . . . . PIPO-MCN-LIDE2/CHFO2 (see appendix)
2. Tanoak minor or absent 3

3. Manzanita sp. >5% & very shallow soils & >20% surface rock . . . . . PIPO-MCN/ARC-CHFO2 (see appendix)
3. Bolander's bedstraw present, not shallow soils & surface rock <20% PIPO-MCN/CHFO2/GABO1

Mountain Dogwood Group

1. Tanoak > 10% 2
1. Not as above 3

2. Hazelnut > 5% PSME-MCN-LIDE2/COCOC
2. Hazelnut absent or minor PSME-MCN-LIDE2-CONU2

3. Hazelnut > 5% PSME-MCN-CONU2/COCOC
3. Hazelnut minor or absent, trailplant, Hooker's fairy bells or sweet cicely present PSME-MCN-CONU2/ADBI

Dry, Moist and Moderate Groups Key

1. Hazelnut > 2%, trailplant or starflower present . . . . . PSME-MCN/COCOC
1. Hazelnut minor or absent 2

2. Bolander's bedstraw or milkwort present, trailplant, false solomon's seal, sweet cicely, Hooker's fairy bells absent or sparse PIPO-MCN/GABO1-POCO6
2. Bolander's bedstraw or milkwort absent, or minor compared to trailplant,false solomon's seal,Hooker's fairy bells, sweet cicely or starflower 3

3. Trailplant present, usually > 5%. Other moist site species present including: false solomon's seal, Hooker's fairy bells, sweet cicely, fragrant bedstraw. Snowberry often present ABCO-MCN/ADBI
3. Trailplant absent or minor compared to starflower 4

4. Starflower present, usually >5% *or* Bolander's bedstraw, trailplant minor to starflower PSME-MCN/TRLA3
4. Starflower absent 5

5. False Solomon's seal or Hooker's fairy bells present, herb layer often sparse ABCO-MCN/SMRA-DIHO2
5. False Solomon's seal and Hooker's fairy bells absent 6

6. Ross' sedge present ABCO-MCN/CARO1
6. Ross' sedge absent 7

7. Snowberry or kellogia present, understory often sparse . . . . . ABCO-MCN/SYMO/KEGA
7. Not as above 8

8. Shallow soils, surface rock typical, serviceberry usually present. Sierra sanicle or lupine typical . . . . . PSME-MCN/AMUT
8. Not as above. Indicator species lacking, densely shaded site, return to step 1 using relative covers.

Evergreen Shrub Group

1. Vine maple > 10% 2
1. Vine maple minor or absent 3

2. Bush chinquapin > 10% ABCO-MCN/ACCI-CHSE2 (see appendix)
2. Bush chinquapin minor or absent . . . . . not in key

3. Huckleberry oak or shrubby canyon live oak > 10% 4
3. Huckleberry oak minor or absent 5

4. Granite rock outcrops, trees and huckleberry oak or shrubby canyon live oak scattered in cracks or pockets of soil . . . . . PIPO-MCN/QUCHN-QUVA(see appendix)
4. Serpentine substrate, huckleberry oak often dense . . . . . PIPO-MCN/QUVA serpentine
4. Very shallow metasedimentary substrates, surface gravels and rock high . . . . . PSME-MCN/QUVA (see appendix)

5. Bush chinquapin > 10% 6
5. Not as above 7

6. Vine maple > 10% . . ABCO-MCN/ACCI-CHSE2 (see appendix)
6. Vine maple minor or absent ABCO-MCN/CHSE2

7. Huckleberry oak >2% . . . . PSME-MCN/QUVA (see appendix)
7. Not in key

Tanoak Group

1. Hazelnut > 5% PSME-MCN-LIDE2/COCOC
1. Not as above 2

2. Mountain dogwood > 10%, starflower usually present PSME-MCN-LIDE2-CONU2
2. Mountain dogwood minor or absent 3

3. Bearclover > 10% . . PIPO-MCN-LIDE2/CHFO2 (see appendix)
3. Bearclover minor or absent 4

4. Snowberry and/or iris present, understory often sparse 5
4. Indicator species lacking, densely shaded site, return to step 1 using relative covers.

5. Tanoak only present in low growing or shrub form PSME-MCN/LIDEE/IRI (see PSME-MCN-LIDE2/IRI type)
5. Shrub form tanoak absent, tree form tanoak present PSME-MCN-LIDE2/IRI

Canyon Live Oak Group

1. Bearclover > 10% PIPO-MCN-QUCH2/CHFO2
1. Not as above 2

2. Sword fern present PSME-MCN-QUCH2/POMU1
2. Not as above 3

3. Bolander's bedstraw or Watson's bedstraw present, poison-oak usually present PIPO-MCN-QUCH2/GABO1
3. Not covered in classification-notify Zone Ecologist

Association Descriptions

MIXED CONIFER SERIES GROUP

The mixed conifer zone of the northern Sierra Nevada and the southern Cascades is described here primarily for the slopes west of the crest. The mixed conifer zone is comprised of a diverse mixture of montane trees, dominated by conifers including white fir, Douglas-fir, incense cedar, ponderosa pine, and sugar pine. The hardwoods black oak and canyon live oak are common as well. It is common for at least four conifer species to co-occur on a site. The species occur in a complex set of combinations that varies with environment, site history and seed availability. The co-occurrence of several species of conifers is not uncommon in many forests in North America. The Sierra Nevada is somewhat unusual in having a consistent pattern of complex co-domination, so that typically no one or even two species dominate a very large area. This diverse co-occurrance pattern of montane conifer species is a result of their widely overlapping environmental tolerances, complex geology, and variable topography in the Sierra Nevada and southern Cascade montane landscape.

Originally, a single "mixed conifer" series was identified, due to the complexity of co-domination of varied montane conifer species. However, the term "mixed conifer" is general and has been applied to forests comprised of widely contrasting mixtures of very different conifer species from Alaska to California . The term "mixed conifer" is also not consistent with the concept of potential natural vegetation, the common classification approach of the Forest Service.

Despite the complexity of tree composition in the mixed conifer zone in the northern Sierra Nevada and southern Cascades, there are some distinct general trends in species occurrence that permit a more specific classification. Analysis of the large data set available here (almost 500 plots) resulted in identification of three separate series within the mixed conifer zone. The three series are Douglas-fir -mixed conifer, ponderosa pine-mixed conifer, and white fir-mixed conifer. Both variation in species composition and species-environmental relationships were examined. There are distinct trends in the distribution of these series in the environment, especially with respect to elevation and potential annual solar radiation (PASI). The Douglas-fir -mixed conifer series occurs at lower elevations and moister sites (higher precipitation or soil moisture and humidity), more often on north or east-facing lower or mid-slopes. The white fir-mixed conifer series occurs at higher elevations, bordering the transition into the pure white fir series and red fir series. The ponderosa pine-mixed conifer series occurs at varied elevations on sites with high PASI and/or shallow, rocky or serpentine soils. While there are distinct environmental trends, there is still considerable overlap among the series, typically with broad transitions. The presence of broad transitions makes the development of a key for identification difficult. However, identification of the individual plant association will lead to identification of the series that the plant association is generally affiliated with.

MIXED CONIFER-MAPLE GROUP

Distribution and Environment: Big-leaf maple occurs extensively in the Pacific northwest and in the North Coast Range of California. In the southern Cascade and northern Sierra Nevada mountain ranges, the distribution of big-leaf maple is scattered, restricted to areas with surface or subsurface water flow. It is most often found in riparian areas but also occurs in local areas at geologic contacts where water comes to the surface.

Most sites are at low or mid elevations within the mixed conifer zone. Big-leaf maple also occurs at lower elevations in the Douglas-fir zone. At higher elevations, it is replaced most commonly by mountain alder. On the Lassen National Forest and to the north, vine maple replaces it at higher elevations or on certain sites. Big-leaf maple occurs on varied aspects, but more commonly on north-facing slopes or in drainages.

Two plant associations were initially described in the mixed conifer-maple subseries including PSME-MCN-ACMA/COCOC and PSME-MCN-ACMA/ADBI. The PSME-MCN-ACMA/COCOC plant association tends to occur on shallow to moderately deep soils, mostly with high coarse fragments, while the PSME-MCN-ACMA/ADBI plant association is found on moderately deep to deep soils. These two types are currently combined due to a low number of samples. Management on sites with the PSME-MCN-ACMA/COCOC association is more limited due to typically steep slopes and shallow or thin, rocky soils. The steep slopes and thin surface A horizon is critical for sustaining productivity. These sites are highly susceptible to fire damage with loss of the A horizon or litter layer.

Additional work in riparian classification will likely result in more big-leaf maple plant associations.

PSME-MCN-ACMA/ADBI

Pseudotsuga menziesii-**mixed conifer**-Acer macrophyllum/Adenocaulon bicolor

Douglas-fir-mixed conifer-big-leaf maple/trail plant

Vegetation Summary Table

(Sample size: 15)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	28	100
ACMA	big-leaf maple	17	100
PSME	Douglas-fir	52	93
CADE3	incense cedar	16	73
CONU2	mt. dogwood	37	67
PILA	sugar pine	9	53
TABR	Pacific yew	3	33
Tree Understory Layer			
ABCO	white fir	4	100
CONU2	mt. dogwood	10	87
PSME	Douglas-fir	3	87
CADE3	incense cedar	5	80
ACMA	big-leaf maple	5	73
PILA	sugar pine	2	53
TABR	Pacific yew	6	20
Shrubs			
SYMO	cr. snowberry	6	73
RUPA2	thimbleberry	5	67
RHRU	Sierra coffeeberry	1	50
COCOC	hazelnut	35	33
Herbs/Grasses			
ADBI	trail plant	10	80
SMRA	Solomon's seal	1	73
TRLA3	starflower	7	67
DIHO2	fairy bells	2	67
CAPR6	Cal. harebell	2	67
OSCH	sweet-cicely	2	60

Environment

Elev: 4200 (3500-5300)

Aspect: N, NE

Slope: 53% (14-75%)

Landfm: lower slopes

PASI: 189 (117-295)

Site Class:1A (1A-1)

FSSC 1,3 (1-3)

Special: Near or in riparian areas, Pacific yew may occur.

Landscape Ecology and Environment:

This association is found primarily near running water or on cool, moist sites with subsurface water flow. The typical area in the landscape occupied by this type ranges from narrow, linear strips along streams or geologic contacts to large hill slopes. This type is found most often on north or northeast-facing, moderate to moderately steep slopes. Soils are often moderately deep with high coarse fragments. Volcanic colluvium was the most common substrate sampled.

Vegetation:

Late seral stands are characterized by a conifer overstory, big-leaf maple in the midstory or regeneration layers, hazelnut sometimes in the shrub layer, and trailplant or starflower in the herb layer. Douglas-fir is dominant in the conifer overstory and regeneration layers, with white fir, sugar pine and incense cedar often present. Conifers and big-leaf maple (indicating surface or subsurface water) co-dominate the mid-story and regeneration layers. Mountain dogwood usually forms a dense, lower midstory.

The shrub and herb layers are variable in cover, decreasing with the denser, multi-layered overstory. Hazelnut is associated with cool, moist conditions along drainages or north-facing concave microsites. Creeping snowberry, thimbleberry, and sierra coffeeberry are common but typically have low covers. Thimbleberry is often associated with seeps, slumps, or landslides. Herb cover varies widely, depending on the overstory cover and presence of small gaps. A mixture of moist site indicators comprises the herb layer, but trailplant and starflower dominate, often forming dense patches. Other herbs are false solomon's seal, fairy bells, and sweet-cicely.

Fire Ecology:

Fires were probably relatively infrequent and usually uneven in spread due to the moist understory conditions, resulting in a mosaic burn pattern. Large white fir in the overstory also support this scenario. The steep slopes might have resulted in higher intensity burns.

Productivity and Management

Timber productivity is moderate to high on these sites. Where slopes are steep and soils have high coarse fragments or may be shallow the site class is often high but stocking is low. This type is not suitable for recreational development or trails due to a high water table. Suitable reforestation species include Douglas-fir, white fir, and sugar pine. Competition from dense understory vegetation is not a major problem due to the high available water. The layered canopy and moist conditions provide suitable habitat for late seral and riparian associated wildlife. Travel corridor potential is high in late seral stages.

MIXED CONIFER-DOGWOOD GROUP

Distribution and Environment: Mountain dogwood occurs throughout the west slope of the Sierra Nevada and Cascade mountains and throughout the Klamath and North Coast ranges.

In the northern Sierra Nevada and southern Cascades, mountain dogwood is found on moist, cool sites throughout the elevational range of mixed conifer. It is most extensive at mid elevations, above 3,000 to 4,000 feet. Mountain dogwood is most often found on east or north-facing slopes or near drainages, where temperatures are cool and humidity higher than surrounding areas. Soils are typically moderately deep to deep, fine textured and moist.

The mountain dogwood group includes two plant associations: PSME-MCN-CONU2/COCOC and PSME-MCN-CONU2/ADBI. PSME-MCN-LIDE2/COCOC and PSME-MCN-LIDE2-CONU2 in the tanoak group also have a high presence of mountain dogwood. The PSME-MCN-CONU2/ADBI plant association is the most prevalent, occupying large acreages on moist, cool sites. PSME-MCN-CONU2/COCOC occurs on moister, more humid sites, typically adjacent to drainages.

Vegetation:

The plant associations in this group are typically multi-layered with a low midstory of dogwood. The height of the dogwood layer decreases at higher elevations and on sites on mid-slopes or farther away from drainages. Conifers occur in several layers. The understory is variable, with highest herb and shrub cover on moister sites and at mid to lower elevations.

Douglas-fir, white fir, and incense cedar are the most prevalent species in the conifer layers. Sugar pine is often present, especially as larger trees, forming an important component. Ponderosa pine is generally absent or scattered. Pacific yew occurs in the mountain dogwood subseries, usually in association with PSME-MCN-CONU2/COCOC.

The associated shrubs and herbs are all indicative of cool, moist sites. The herb layer is typically abundant and diverse, including mostly large-leaved species adapted to cooler, moister conditions such as trail plant, Hooker's fairy bells, starflower and Solomon's seal. Two less common plants that also occur are queen's cup and Hartweg's wild-ginger. The former is often associated with pockets of poorly drained soil.

Fire Ecology:

The natural fire regime for all of the plant associations in the mountain dogwood group probably included low or medium frequency, light to medium intensity fires. The fires that did occur probably spread in a mosaic, due to the typically moist understory conditions. This fire

regime scheme is supported by the scattered occurrence of cat-face fire scars, the prevalence of large white firs in the overstory, and the general absence of ponderosa pine in any of the tree layers. Where the dogwood group reaches mid-slopes, fires might have been more frequent.

Productivity and Management:

The dogwood group is highly productive as indicated by the high basal areas and high stand density index (SDI) values. The average Dunning's site classes are higher in this subseries than any other, with classes of 1A and 1 most prevalent. Seral stage development is relatively fast in the dogwood subseries, due to the favorable growing conditions. Significant numbers of large diameter trees develop within 185 years, or earlier on the moistest sites, sometimes as early as 140 years.

The mountain dogwood group often occurs adjacent to or in riparian areas indicating sites that may be hydrologically sensitive. The presence of Pacific yew often indicates subsurface water.

High vertical structural diversity, abundance of decidous hardwoods, and frequent proximity to water sources make these sites well suited for arboreal wildlife, including insectivorous birds. The dense canopies and understories provide good thermal coverage and highly suitable travel corridor structure.

PSME-MCN-CONU2/COCOC

Pseudotsuga menziesii-mixed conifer-Cornus nuttallii/Corylus cornuta californica

Douglas-fir-mixed conifer-dogwood/hazelnut

Vegetation Summary Table

(Sample size: 12)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	61	100
ABCO	white fir	33	92
CADE3	incense cedar	22	92
CONU2	mt. dogwood	22	83
PILA	sugar pine	12	67
TABR	Pacific yew	24	42
Tree Understory Layer			
CONU2	mt. dogwood	8	92
CADE3	incense cedar	5	92
ABCO	white fir	7	83
PSME	Douglas-fir	5	75
QUKE	black oak	1	75
TABR	Pacific yew	3	50
PILA	sugar pine	2	50
Shrubs			
COCOC	hazelnut	8	100
ROS	rose species	2	75
SYMO	cr. snowberry	4	67
Herbs/Grasses			
ADBI	trail plant	13	92
DIHO2	fairy bells	2	92
SMRA	Solomon's seal	1	92
TRLA3	starflower	12	67
FEOC	western fescue	3	75

Environment

Elev: 4000 (3300-4800)

Aspect: N, NE

Slope: 38% (3-66%)

Landfm: gently sloping lower or mid-slopes

PASI: 192 (143-274)

Site Class: 1A (1A-1)

FSSC 1 (1-2)

Special: May occur adjacent to or in minor riparian areas.

Landscape Ecology and Environment: This association is widespread throughout the northern Sierra Nevada and southern Cascade mountains. It indicates moist, cool, humid sites with rich soils and occupies north-facing, gently to moderately sloping, lower or mid-slopes. Soils are moderately deep to deep, with low coarse fragments and high A.W.C.'s. The association occupies variable areas in the landscape, occurring by itself in small areas, or in complex with other closely related dogwood types in areas up to 100 acres.

Vegetation:

Late successional forests are characterized by a multi-layered conifer overstory, dogwood in the midstory or regeneration layers, and hazelnut in the shrub layer. Douglas-fir dominates or co-dominates with white fir in the conifer layers. Incense cedar and sugar pine are minor components. Pacific yew is often present in the low midstory and regeneration layers, indicating high soil moisture, and cool, moist air. Mountain dogwood and hazelnut also indicate these conditions.

Hazelnut dominates a tall, but often sparse shrub layer. Wild rose species and creeping snowberry are common. The well developed herb and grass layer is comprised of varied moist site indicators. Trailplant and starflower dominate the layer, with false solomon's seal, California harebell, Hooker's fairy bells, and fragrant bedstraw. Western fescue is consistently present, but with low cover.

Fire Ecology:

Fire history data from the Placerville Ranger District on the Eldorado National Forest indicates that fire intervals prior to fire suppression were 25 to 50 years. Few cat-face fire scars were observed on these sites, indicating that fires had very uneven spread and low intensity due to the moist conditions. The high occurrence of Pacific yew in this type, with its thin, fire-susceptible bark, suggests that fire may have been even more uncommon than the above fire interval suggests.

Productivity and Management

This type is very productive with high site classes and stocking due to the abundant water present. High water tables are sometimes associated with this type and heavy timber harvest may increase the risk of puddling and slow regeneration due to poor root aeration. Partial cutting may increase windthrow, therefore small openings are suggested. Skid trails, landings, and roads should be placed to avoid depressed microsites with concentrated water. Rapid growth of understory shrubs and dogwood seedlings may hinder natural stocking initially, but shouldn't be a major problem. The dense, highly layered canopies provide high quality habitat for late seral dependent species including the spotted owl, fisher, and pine marten. The deciduous hardwoods provide suitable habitat for neotropical birds. Amphibians may occur near moist logs or seeps.

PSME-MCN-CONU2/ADBI

Pseudotsuga menziesii-mixed conifer-Cornus nuttallii/Adenocaulon bicolor

Douglas-fir-mixed conifer-mountain dogwood/trail plant

Vegetation Summary Table

(Sample size: 22)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	42	100
PSME	Douglas-fir	30	100
CONU2	mt. dogwood	21	91
CADE3	incense cedar	18	91
PILA	sugar pine	18	73
TABR	Pacific yew	3	5
Tree Understory Layer			
CONU2	mt. dogwood	12	100
ABCO	white fir	6	100
CADE3	incense cedar	5	100
PSME	Douglas-fir	1	100
PILA	sugar pine	1	73
TABR	Pacific yew	6	5
TOCA	Ca nutmeg	4	5
Shrubs			
SYMO	cr. snowberry	3	77
ROS	rose species	4	54
Herbs/Grasses			
ADBI	trail plant	7	73
DIHO2	fairy bells	2	73
SMRA	Solomon's seal	1	59
TRLA3	starflower	11	45
GATR2	fr. bedstraw	2	45
OSCH	sweet-cicely	2	45

Environment

Elev: 4300 (3200-5500)

Aspect: N, NE, NW

Slope: 28% (3-50%)

Landfm: lower to mid-slopes

PASI: 222 (161-277)

Site Class: 1A (1A-1)

FSSC 2 (1-3)

Special: Pacific yew or California nutmeg may occur.

Landscape Ecology and Environment:

This type is widespread and indicates cool, moist sites with productive soils. Sites are on north, northwest or northeast-facing, mid to lower slopes. Soils are well developed on volcanic or granitic substrate. Coarse fragments are typically low and A.W.C.'s high. It occupies large areas in the landscape, sometimes dominating whole slopes. A variation of this type, MCN-CONU2/CHSE2, occurs where soils have high coarse fragments on moderately steep slopes, usually above 4600 feet. This CHSE2 type occupies small areas, often near creeks or springs.

Vegetation:

Late seral forests are characterized by a dense, multi-layered conifer overstory, mountain dogwood in the overstory or understory, and trailplant or Hooker's fairy bells in the herb layer. Douglas-fir dominates or co-dominates the overstory with white fir and/or incense cedar. Sugar pine is frequently a minor component. Dogwood mostly forms a low mid-story, but sometimes is only present in the regeneration layer. Both Pacific yew and California nutmeg occur infrequently.

Shrubs are rarely present in high amounts, but creeping snowberry, wild rose, and bush chinquapin (on rockier sites) are the most common. Thimbleberry occurs often and indicates seeps, high water tables or mass movement. The moist site indicators, starflower and trailplant, usually dominate the herb layer. The well developed herb layer includes false Solomon's seal, fragrant bedstraw, queen's cup, and Hartweg's wild ginger.

Fire Ecology:

Under a natural fire regime, fires were only moderately frequent, primarily low intensity, and highly variable in spread due to the moist environment and lower slope topographic position. Few cat-face fire scars and fairly high numbers of large white fir support this suggested fire regime.

Productivity and Management

High soil moisture and fine soils result in high productivity with high site class and stocking. Silvicultural options are generally open, although early season equipment operations should be limited due to wet soils. The CHSE2 type has lower stocking and shrub competition may be high. Douglas-fir, white fir, ponderosa pine, and sugar pine are suitable reforestation species. The dense, multilayered canopies provide quality habitat for late seral dependent wildlife and proximity to water may provide suitable amphibian and neotropical bird habitat.

MIXED CONIFER-TANOAK GROUP

Distribution and Environment: Tanoak reaches its greatest distribution in California in the North Coast Range, where precipitation is high. In the Sierra Nevada and southern Cascade mountains, tanoak occupies local areas where high precipitation occurs, mostly in the form of rain or rain and snow. Tanoak is most prevalent on the Plumas and Tahoe National Forests. It also occurs in large areas on the Georgetown Ranger District of the Eldorado National Forest.

Most sites are at low or mid elevations within the mixed conifer zone. Tanoak also occurs at lower elevations in limited cool, moist sites where the Douglas-fir series occurs in small amounts. Tanoak occurs on varied aspects, but most often where the microclimate is moist and cooler, such as in drainages or on north or east-facing lower slopes, especially at lower elevations.

Four associations are described in the Mixed Conifer-Tanoak group including PSME-MCN-LIDE2/COCOC, PSME-MCN-LIDE2-CONU2, PSME-MCN-LIDE2/IRI, and PIPO-MCN-LIDE2/CHFO2. Another possible type, PSME-MCN/LIDEE/IRI, also occurs on shallow metamorphic soils. It is floristically similar to the PSME-MCN-LIDE2/IRI type but the tanoak is predominately in the shrub or low growing form. Although there are not enough plots to separate the PSME-MCN/LIDEE/IRI type at this time, the management is significantly different and will be described separately. These plant associations are listed in order of a gradient from cool/wet to cool/moist to dry.

Vegetation:

All of the associations in this subseries have a characteristic multi-layered or bi-layered canopy structure. A conifer overstory of varied composition and a dense mid-story of tanoak is typical. The shrubform of tanoak occurs mostly in combination with bearclover and bush chinquapin found at higher elevations or on harsh sites. Other hardwood species such as dogwood, hazelnut, and big-leaf maple may also contribute to a diverse mid-story layer. This often dense, layered canopy results in little light reaching the understory. Herbs and shrubs are often sparse in cover or restricted to canopy openings where light reaches the forest floor.

The conifer overstory is comprised of varied combinations of white fir, Douglas-fir, incense cedar, sugar pine, and ponderosa pine. The most prevalent species are white fir and Douglas-fir. Sugar pine and incense cedar are nearly constant minor components. Ponderosa pine is more common in the drier plant associations or following stand-opening disturbance.

Many of the associated mid-story canopy species and shrubs are indicative of cooler, moist or wet sites. Dogwood and hazelnut typically occur in areas with higher soil moisture and cooler, more humid air. Hazelnut often indicates wet soils. Big-leaf maple is generally restricted to areas with surface or subsurface water.

Fire Ecology:

Due to the tendency of the tanoak plant associations to occur in cooler, moister microclimates, the natural fire regime probably included low frequency or medium frequency light fires. This is especially likely for the moister associations PSME-MCN-LIDE2/COCOC and PSME-MCN-LIDE2-CONU2. This is supported by the existence of large, old white fir in the overstory, since white fir is not tolerant of frequent or high intensity fires. The drier associations, PSME-MCN-LIDE2/IRI and PIPO-MCN-LIDE2/CHFO2, probably experienced more frequent fires, sometimes with greater intensities. Tanoak makes abundant and very flammable fuel ladders that would cause higher intensity fires. This is evident in the greater prevalence of tanoak in the regeneration layer versus the overstory of the drier type. Tanoak resprouts following fires, possibly explaining the dense understory layer in the drier types. Ponderosa pine and black oak are two generally seral species, that are more prevalent in these drier types as well, suggesting some influence of fire on species composition.

Productivity and Management

The tanoak group is generally very productive or at least moderately productive, with Dunning's site classes of 1,2, and 3 most common. Shrubform tanoak often indicates lower site classes of 3, 4 or 5. The wet or moist associations are often found adjacent to or near drainages and therefore indicate sensitive sites in the watershed, sometimes riparian areas. Tanoak readily resprouts and quickly dominates sites following disturbance. Competition from tanoak can be intense.

The high vertical structural diversity of most of the tanoak subseries and frequent proximity to water sources, makes these sites well suited for arboreal wildlife. Dense, multi-layered canopies provide thermal cover but forage is sparse due to the low cover in the understory.

PSME-MCN-LIDE2/COCOC

Pseudotsuga menziesii-mixed conifer-Lithocarpus densiflorus/Corylus cornuta californica

Douglas-fir-mixed conifer-tanoak/hazelnut

Vegetation Summary Table

(Sample size: 18)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	51	100
PILA	sugar pine	12	94
LIDE2	tanoak	28	89
CONU2	mt. dogwood	17	83
CADE3	incense cedar	14	83
ABCO	white fir	23	78
PIPO	ponderosa pine	11	56
QUKE	black oak	17	50
Tree Understory Layer			
LIDE2	tanoak	18	94
CONU2	mt. dogwood	8	83
CADE3	incense cedar	3	83
PSME	Douglas-fir	2	83
QUKE	black oak	2	67
ABCO	white fir	2	67
ACMA	big-leaf maple	2	61
TABR	Pacific yew	2	44
Shrubs			
COCOC	hazelnut	7	100
ROS	rose species	4	45
Herbs/Grasses			
TRLA3	starflower	10	89
ADBI	trailplant	7	56
ASHA	H. ginger	2	17

Environment

Elev: 3400 (2200-4700)

Aspect: W, N, E,

Slope: 43% (12-69%)

Landfrm: drainages, lower or mid-slopes

PASI: 237 (170-311)

Site Class: 1A (1A-1)

FSSC 2 (1-2)

Special: Wet, sometimes riparian areas

Landscape Ecology and Environment: This association indicates wet areas with high annual precipitation and relatively cool, moist air. It is found at lower elevations in the mixed conifer zone on northerly slopes or in drainages. Soils are typically moderately deep to deep. PSME-MCN-LIDE2/COCOC typically occurs in small or medium size areas, often linear in shape, reflecting the association with drainages or moist sites. It is often bounded on the upland side by PSME-MCN-LIDE2-CONU2 or PSME-MCN-LIDE2/IRI.

Vegetation:

Late seral stands are characterized by a multi-layered conifer overstory, tanoak in the midstory or regeneration layers, and hazelnut in the shrub layer. Dogwood or big-leaf maple often occupy a second, lower midstory, both indicating moist soils and air. Tanoak indicates high precipitation. The conifer overstory is dominated by various mixtures of Douglas-fir and white fir. Incense cedar and sugar pine are minor components. Ponderosa pine and black oak sometimes occur in low amounts. Tree regeneration is often dominated by tanoak, with white fir, incense cedar, and Douglas-fir present in low amounts.

The shrub layer is often sparse, due to the dense overstory tree canopies. Hazelnut is consistently present and indicates moist or wet soils and moist air. The varied mixture of moist site indicator herbs also reflects a cool moist environment. Starflower is the most prevalent herb, with trail plant, false Solomon's seal, and sweet-cicely also common. Hartweg's wild-ginger, an uncommon plant, was found at several sites.

Fire Ecology:

The moist, cool environment and stand structures suggest that the typical natural fire regime included infrequent, medium or low intensity fires, uneven in spread due to the moist understory conditions, resulting in a mosaic burn pattern.

Productivity and Management:

Productivity is high (Dunning's site class 1A or 1) due to the high precipitation, soil moisture and air humidity. Management should be evaluated on a site specific basis and limited on sites with possible high water tables or mass movement. Competition from deerbrush or tanoak can be intense. Dense, multi-layered canopies provide suitable habitat for late seral dependent wildlife, travel corridors, and thermal cover for deer. When near drainages or on wet soils this type can provide habitat for amphibians and neotropical birds. The sensitive species, Klamath Mountain bilberry, may occur in this type.

PSME-MCN-LIDE2-CONU2

Pseudotsuga menziesii-mixed conifer-Lithocarpus densiflorus-Cornus nuttallii

Douglas-fir-mixed conifer-tanoak-dogwood

Vegetation Summary Table

(Sample size: 10)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	33	100
ABCO	white fir	25	100
CADE3	incense cedar	22	100
CONU2	mt. dogwood	15	90
PILA	sugar pine	13	80
LIDE2	tanoak	45	70
TABR	Pacific yew	9	20
Tree Understory Layer			
LIDE2	tanoak	26	100
CONU2	mt. dogwood	8	100
CADE3	incense cedar	5	100
ABCO	white fir	2	100
PSME	Douglas-fir	2	90
PILA	sugar pine	2	80
TABR	Pacific yew	4	40
Shrubs			
ROS	rose species	2	60
Herbs/Grasses			
TRLA3	starflower	11	70
IRHA	Hartweg's iris	3	60
VILO	pine violet	2	60
SMRA	solomon's seal	2	50

Environment

Elev: 3800 (3200-4500)

Aspect: E, NE, SE

Slope: 28% (5-48%)

Landfrm: mid to lower slopes

PASI: 246 (183-289)

Site class: 1A (1A-1), FSSC 2 (1-2)

Special: May occur near seasonal drainages.

Landscape Ecology and Environment: This type indicates high precipitation and moist, humid conditions. Sites are typically north, east, northeast or northwest facing, moderately steep, mid to lower slopes. It is located adjacent to PSME-MCN-LIDE2/COCOC on moister sites and PSME-MCN-LIDE2/IRI on drier sites. It occupies moderate to large areas on the landscape.

Vegetation:

Late seral forests are characterized by a multi-layered conifer overstory, and both mountain dogwood and tanoak in the midstory or regeneration layers. Douglas-fir or, less frequently, white fir dominates the conifer overstory. Sugar pine, incense cedar, and white fir are consistent minor associates. Tanoak dominates the midstory and/or regeneration layers, often with high cover. Mountain dogwood is consistently present in a lower midstory and regeneration layer. Tanoak indicates high precipitation, while mountain dogwood indicates moist soils and relatively cool temperatures. Conifer regeneration is often sparse because of the dense conifer and hardwood overstories. Pacific yew occurs rarely in the overstory but often in the regeneration layer.

The shrub layer is generally sparse, due to the dense tree canopies. Rose species are the most prevalent. Three relatively uncommon, wet site shrubs, Oregon spicy wintergreen, Sierra laurel, and western azalea, were observed on several plots, suggesting that some sites may support unusual and diverse plant communities. The herb layer is variable under the dense tree overstory, but can be well developed, dominated by moist site indicators, such as starflower, false solomon's seal, and trailplant. Shade tolerant, moderate site indicators including pine violet and Hartweg's iris may occur, suggesting slightly drier sites (often a transition to drier types).

Fire Ecology:

The typical topographic position on lower or mid, north-facing slopes suggests a natural fire regime of infrequent, low or medium intensity, variably spreading fires. This is supported by the visible fire evidence observed, with fire scars seen on half of the plots.

Productivity and Management

Timber productivity is high in this type, with both high site classes and stocking. Dunning's site class 1A and 1 are typical. Silvicultural options are generally open, although some sites may have high water tables that may cause windthrow problems. Partial harvest is recommended to avoid further raising of the water table that could hinder regeneration. Competition from deerbrush may be intense. The typically layered tree canopies provide quality late seral dependent wildlife habitat. Sites with dense tanoak may make foraging for spotted owls difficult. Dense canopies result in little forage for deer and cattle in mature and late seral forests.

PSME-MCN-LIDE2/IRI

Pseudotsuga menziesii-mixed conifer-Lithocarpus densiflorus/Iris
Douglas-fir-mixed conifer-tanoak/iris

Vegetation Summary Table
(Sample size: 22)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	32	100
PILA	sugar pine	18	95
ABCO	white fir	31	91
PIPO	ponderosa pine	23	77
CADE3	incense cedar	18	77
LIDE2	tanoak	24	59
QUKE	black oak	7	55
Tree Understory Layer			
ABCO	white fir	3	86
PSME	Douglas-fir	3	82
LIDE2	tanoak	20	77
PILA	sugar pine	2	77
CADE3	incense cedar	3	73
QUKE	black oak	3	64
Shrubs			
SYMO	cr. snowberry	2	59
Herbs/Grasses			
IRI	iris species	1	68
CHUM	w. prince's pine	3	45
POCO6	milkwort	2	41
VILO	pine violet	2	41

Environment

Elev: 4200 (2600-5400)

Aspect: SW, S, SE

Slope: 31% (5-59%)

Landfrm: mid- to upper slopes benches

PASI: 255 (177-299)

Site class: 1 (1A-2)

FSSC 3 (1-3)

Special: On Hurlbut or other shallow soils, LIDEE may occur

Landscape Ecology and Environment: This type indicates high precipitation but relatively dry soils for the LIDE2 subseries. Sites are on south or east-facing, mid to upper slopes or benches. Slopes are variable, but typically moderately steep to steep. Solar insolation is usually high. Soils are primarily moderately deep, but some are shallow. The sites on shallow soils (primarily Hurlbut series) likely represent a distinct ecological type and the management interpretations are described separately below. Parent material is variable but dominantly metamorphic. This type often occurs on areas of moderate size in the landscape.

Vegetation:

Late seral forests are characterized by a moderately dense to open conifer overstory, tanoak in the midstory, shrub or regeneration layers, and iris or creeping snowberry in the understory. Douglas-fir, ponderosa pine, and sugar pine typically dominate the overstory in varied mixtures. White fir and incense cedar are consistent minor components in the overstory, but are more prevalent in the midstory or lower overstory. Tanoak may form a scattered or occasionally dense midstory, and tanoak regeneration is high in cover. Tanoak indicates high precipitation. Douglas-fir, white fir, and incense cedar co-dominate conifer regeneration. Sugar pine is common, but in low densities. Ponderosa pine regeneration is scattered and low in amount.

The shrub layer is either well developed and dominated by shrub form tanoak or sparse, with scattered occurrences of creeping snowberry or rose the most common. The shrub form of tanoak is difficult to taxonomically identify, but where definitively identified, it seems to indicate shallow soils (i.e. Hurlbut soil series) or high elevation sites. Iris is the most consistent component of the usually sparse understory, indicating dry sites. A mixture of dry and moderate site herb indicators occur in low amounts, including: dry sites-Bolander's bedstraw, milkwort, dogbane and iris; moderate sites- pine violet, western prince's pine, and multi-stemmed sedge. Starflower often occurs, but in low amounts, indicating slightly moister but warm sites.

Fire Ecology:

The topographic position of mid to upper, south or east-facing slopes suggests that the natural fire regime includes medium to high frequency, low intensity, variably spreading fires. Variable fire evidence was observed, indicating differing fire regimes on the east versus south slopes, or mid-slopes versus benches or upper slopes. Tanoak makes abundant and very flammable fuel ladders that would cause higher intensity fires.

Productivity and Management

Productivity is moderate to high, except on the shallow soil sites where it is low. Productive sites have high to moderate Dunning's

site classes of 1A to 2 and high stocking. Tanoak can comprise a high proportion of the stocking. Silvicultural options are open on the productive sites. Competition from deerbrush or tanoak can be intense.

The productive sites have highly layered canopies providing suitable spotted owl foraging, good thermal cover for deer, and moderately suitable travel corridor habitat for pine marten or fisher. When black oak is present, the site can provide good forage or transition range for deer. The sensitive plants, Butte fritillary or woolly violet, may occur in this type.

PSME-MCN/LIDEE/IRI

Pseudotsuga menziesii-mixed conifer/Lithocarpus densiflorus var. echinoides /Iris
Douglas-fir-mixed conifer/shrub form tanoak/iris

Special Note: This type is floristically similar to the PSME-MCN-LIDE2/IRI type but differs significantly in management. There are not enough plots to describe it separately at this time, but specific management interpretations follow.

Landscape Ecology and Environment: This type was sampled primarily on the Tahoe National Forest. It indicates high precipitation but relatively dry soils for the LIDE2 subseries. Sites are on south or east-facing, mid to upper slopes or ridges. Slopes are variable, but typically moderately steep to steep. Solar insolation is usually high. Soils are shallow, developed on metasedimentary substrate, and are in the Hurlbut soil series. This type often occurs on areas of moderate size in the landscape.

Vegetation:

Late seral forests are characterized by an open conifer overstory, low growing or shrub form tanoak in the shrub layer, and iris or creeping snowberry in the understory. Douglas-fir, ponderosa pine, and sugar pine typically dominate the overstory in varied mixtures. White fir and incense cedar are consistent minor components in the overstory, but are more prevalent in the midstory or lower overstory. Tanoak indicates high precipitation. Douglas-fir, white fir, and incense cedar co-dominate conifer regeneration. Sugar pine is common, but in low densities. Ponderosa pine regeneration is scattered and low in amount.

The shrub layer is well developed and dominated by shrub form tanoak. The shrub form of tanoak is difficult to taxonomically identify, but where definitively identified, it seems to indicate shallow soils (i.e. Hurlbut soil series) or high elevation sites. Iris is the most consistent component of the usually sparse understory, indicating dry sites. A mixture of dry and moderate site herb

indicators occur in low amounts, including: dry sites-Bolander's bedstraw, milkwort, dogbane, and iris; moderate sites-pine violet, western prince's pine, and multi-stemmed sedge.

Fire Ecology:

The topographic position of mid to upper, south or east-facing slopes suggests that the natural fire regime includes medium to high frequency, low intensity, variably spreading fires. Variable fire evidence was observed, indicating that the fire regime differs on the east versus south slopes, or mid-slopes versus benches or upper slopes. Tanoak makes abundant and very flammable fuel ladders that would cause higher intensity fires.

Productivity and Management

Productivity is moderate to low, with moderate to low site class and low stocking. Individual trees growing in fractures in the bedrock or pockets of deeper soil can have a higher site class. Relying on natural regeneration is recommended, although stocking control may be necessary. Because of thin surface soils and litter cover, it is critical to maintain organic material (litter and logs) to maintain long-term productivity. Longer rotations are recommended.

The sensitive plants, Butte fritillary or woolly violet, may occur in this type.

MIXED CONIFER-BEARCLOVER GROUP

Distribution and Environment: The bearclover group occurs from the Stanislaus north to the southern Shasta National Forest. It is most extensive from the Foresthill Ranger District of the Tahoe National Forest south to the Stanislaus, often occupying large areas.

Bearclover is found primarily at low to mid-elevations in the mixed conifer zone. In the northern Sierra Nevada and southern Cascades it is most common on ridgetops and upper, south-facing slopes. The subseries is found on varied bedrock types but is most often on volcanic substrates. This may be due to the prevalence of volcanic flows on ridgetops in mid-elevations in the northern Sierra Nevada. Soils tend to be moderately deep to deep, with variable coarse fragments.

Two plant associations are included in the mixed conifer-bearclover group. The most widespread plant association in the group, PIPO-MCN/CHFO2/GABO1, occurs on soils with relatively high A.W.C.'s. The PIPO-MCN/ARC-CHFO2 plant association occurs on shallow soils, especially the Ledmont soil series. Two other closely related plant associations from other subseries have a bearclover component. The PIPO-MCN-LIDE2/CHFO2 type occurs in areas of high precipitation, often in a broad zone of transition between PIPO-MCN/CHFO2/GABO1 on the ridgetops and LIDE2 types on the slopes below. The PIPO-MCN-QUCH2/CHFO2 type occurs on shallow soils or soils with high coarse fragments.

The PIPO-MCN/ARC-CHFO2 and the PIPO-MCN-LIDE2/CHFO2 types are undersampled and therefore are only described in the Appendix.

Vegetation:

An open, uni- or bi-layered conifer canopy over a dense shrub layer is the typical vegetation structure. Black oak often forms a scattered mid-story.

The conifer overstory is dominated by ponderosa pine, with incense cedar a consistent minor component. Sugar pine is also common. Douglas-fir and white fir are less common, usually occurring in low amounts when present. The latter two species usually occur in transitional areas to other mixed conifer types or in the PIPO-MCN-LIDE2/CHFO2 type. This group contains some of the few mixed conifer plant associations where ponderosa pine is found regenerating naturally in the absence of natural fire. This is probably a reflection of the open canopy.

Bearclover usually forms a dense, low shrub layer. Manzanita species may be present in variable amounts, increasing following fire. On shallow, rocky soils, the manzanita may persist with successional development.

The herb layer is variable, with cover inversely related to bear clover cover. The species are indicative of open, sunny and often dry sites.

Diversity of herbs is generally low, although in the PIPO-MCN/ARC-CHFO2 plant association, where CHFO2 is often patchy, the diversity can be high.

Fire Ecology:

The natural fire regime of the mixed conifer-bearclover subseries includes frequent low intensity fires. This is related to its topographic position on ridgetops and upper south-facing slopes. The open forests of this subseries do not produce much large fuel, but the volatile oils in bearclover leaves ensure that fires spread thoroughly throughout these sites. Higher intensity fires result in an increase in manzanita.

Productivity and Management:

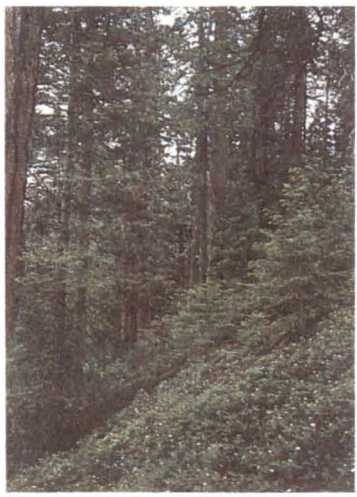
Productivity is moderate to low in the mixed conifer-bearclover subseries. Although soils are often moderately deep to deep, the high solar insolation and heavy competition from bearclover limits tree stocking and growth. Dunning's site classes 2 and 3 are typical of the PIPO-MCN/CHFO2/GABO1 plant association. The rockier sites occupied by the PIPO-MCN/ARC-CHFO2 plant association result in lower productivity, with site classes 4 or 5 occurring.

The open overstory with low tree covers make these plant associations of low suitability for late seral dependent wildlife habitat or corridors. Thermal cover is also low. The prevalence of black oaks and young bearclover shoots provides forage for deer and rodents. On the Georgetown Ranger District of the Eldorado National Forest, there is some indication that following burning of bearclover plant associations, dense stands of grass may develop providing abundant forage.
The dense, low growing cover of bearclover provides good ground cover to prevent soil erosion from precipitation events.

PIPO-MCN/CHFO2/GABO1

Pinus ponderosa-mixed conifer/Chamaebatia foliolosa/
Galium bolanderi

ponderosa pine-mixed conifer/bearclover/Bolander's bedstraw



Vegetation Summary Table

(Sample size: 14)

		Cover	Cons
Tree Overstory Layer			
PIPO	ponderosa pine	41	93
CADE3	incense cedar	27	93
QUKE	black oak	7	79
PSME	Douglas-fir	16	71
ABCO	white fir	7	71
PILA	sugar pine	13	64
ARME3	madrone	3	14
Tree Understory Layer			
QUKE	black oak	2	100
CADE3	incense cedar	11	93
PSME	Douglas-fir	3	71
PIPO	ponderosa pine	2	71
PILA	sugar pine	2	57
ABCO	white fir	2	50
Shrubs			
CHFO2	bearclover	51	100
Herbs/Grasses			
GABO1	B. bedstraw	1	64
IRHA	Hartweg's iris	2	64
POCO6	milkwort	2	50

Environment

Elev: 4300 (3300-5700)

Aspect: SW, SE

Slope: 17% (3-43%)

Landfm: ridges, upper slopes

PASI: 267 (229-301)

Site Class: 2 (1A-3)

FSSC 3 (2-4)

Landscape Ecology and Environment: This association indicates hot, dry, sunny conditions occurring primarily on ridge-tops and south-facing upper slopes. Soils are moderately deep to deep, and well developed with low coarse fragments, on volcanic or metamorphic substrates. The PIPO-MCN/CHFO2/GABO1 plant association occurs in large areas, either alone or in a mosaic with PIPO-MCN/GABO1-POCO6 or PSME-MCN/TRLA3.

Vegetation:

Late seral stands are characterized by an open canopy of large, widely spaced conifers and a dense, low carpet of bearclover in the understory. Ponderosa pine dominates the overstory and regeneration layers. Incense cedar and black oak comprise consistent minor components. Sugar pine, Douglas-fir, and white fir occasionally occur, often associated with ecotones to other plant associations. An open overstory results in the consistent presence of pine regeneration in the understory, unlike most other late seral mixed conifer types.

Bearclover forms a dense, often continuous shrub layer. Manzanita may be present, indicating past disturbance. Dry site indicator herbs such as Bolander's bedstraw or milkwort are scattered throughout the bearclover, usually with low cover. Hartweg's iris is also common.

Fire Ecology:

Data from a fire history study on the Placerville Ranger District, on the Eldorado N. F. suggests that under a natural fire regime, these sites burned frequently (5-10 years) with low intensity fires. Intensities were likely higher and spread more uniformly than on other similar sites due to the bearclover. Cat-face fire scars and charred bark were observed in all of the plots sampled and on many of the trees at each site, supporting this proposed regime. Repeated fires might have kept bearclover in check and increased the grass component.

Productivity and Management:

Productive soils with often intense competition from bearclover results in moderately good tree growth but low stocking in this type. Natural regeneration is not sufficient to be a reliable replacement for intensive harvest. Intensive management is necessary to manage competition from bearclover to establish artificial regeneration. Ponderosa pine and sugar pine are the primary suitable reforestation species. Artificial regeneration is problematic at elevations below 4,000 feet. The open canopy, presence of oaks, and dense bearclover can provide good deer habitat. Young bearclover shoots provide nutritional browse for deer. Repeated burns can maintain young shoots and sometimes increase grass cover. Cavity nesting woodpeckers are likely to occur. Ecotonal sites with higher canopy cover may be marginally suitable for spotted owl foraging.

MIXED CONIFER-CANYON LIVE OAK GROUP

Distribution and Environment: Canyon live oak is the most widely distributed oak in California (Griffin and Critchfield 1976). It occurs primarily on steep and rocky slopes in major canyons. The canyon live oak subseries is restricted to these habitats in the mixed conifer zone of the northern Sierra Nevada and southern Cascades. Pure canyon live oak forests occupy the harshest sites, with the mixed conifer-canyon live oak group intermixed where some soil development has occured.

The mixed conifer-canyon live oak group occurs at low to mid-elevations in the mixed conifer zone. At elevations below 2,000 to 3,000 feet, the Douglas-fir-canyon live oak or foothill pine-canyon live oak series integrate into the mixed conifer zone. Soils of the mixed conifer-canyon live oak group are typically shallow or high in coarse fragments. The group may also occur on moderately deep soils where the bedding plane of the bedrock prevents root penetration (no fracturing). Aspect is variable but due to the prevalent east-west orientation of major canyons, north and south-facing slopes are typical. Temperatures are generally hot for the mixed conifer zone due to the exposed sites and low elevation distribution.

Three plant associations have been identified to date in the mixed conifer-canyon live oak group. More plant associations likely occur, but have not been identified yet due to sparse sampling in this group and related canyon live oak series and subseries. The plant associations identified are PSME-MCN-QUCH2/POMU1, PIPO-MCN-QUCH2/GABO1, and PIPO-MCN-QUCH2/CHFO2, listed in order of a gradient of moist to dry.

Vegetation:

A bi-layered canopy structure typifies the mixed conifer-canyon live oak subseries. An open conifer overstory and often dense canyon live oak mid-story are typical. This subseries often occupies a broad transition between conifer dominated and canyon live oak dominated forests. This juxtaposition results in a variety of conifer-canyon live oak structures. On sites closer to the conifer dominated forests, the mixed conifer-canyon live oak group often has a structure of an open conifer forest, with an occasional canyon live oak in the mid-story but well represented in the regeneration layer.

The open conifer overstory is comprised primarily of ponderosa pine, incense cedar, sugar pine and sometimes Douglas-fir. Douglas-fir is an important component most often in the PSME-MCN-QUCH2/POMU1 type which tends to occur on north slopes or in ravines. Black oak is commonly present in moderate amounts. Interior live oak or California nutmeg may occur but are uncommon.

The understory is variable with the plant association. The moister plant associations and the PIPO-MCN-QUCH2/CHFO2 plant associations generally have well developed herb and shrub layers, while the

understory of the PIPO-MCN-QUCH2/GABO1 plant association is often sparse and patchy.

Fire Ecology:

The prevalence of the mixed conifer-canyon live oak subseries on exposed, often hot, steep slopes indicates a natural fire regime of frequent low intensity and occasional high intensity fires. This is supported by the prevalence of ponderosa pine in the overstory and the typically multi-stemmed black oaks observed.

Productivity and Management:

Productivity is generally low in the mixed conifer-canyon live oak subseries, although trees growing in deep pockets of soil may grow well. Conifer stocking is generally low due to shallow or rocky soils and abundance of canyon live oak. Dunning's site classes of 3, 4 or 5 are most common, with 1 or 2 sometimes occurring when site trees occur in the pockets of deeper soil. The low A.W.C. and high growing season temperatures are likely the most limiting tree growth factors. Natural regeneration of conifers appears most successful under the partial shade of the hardwoods.

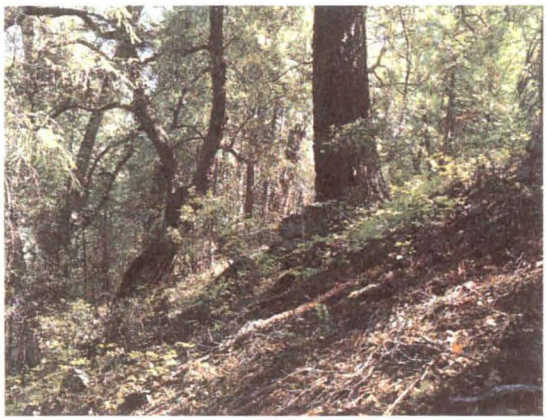
The prevalence of this subseries in steep, canyon slopes indicates a high correlation with inner-gorge areas. Probability of landslides may be high on steeper sites (>60% slope).

Overstory canopy covers are often moderate to low, providing moderately low to low travel corridor suitability. California spotted owl may occur in associated riparian areas at low elevations (Verner et al. 1992), especially proximal to the PSME-MCN-QUCH2/POMU1 type.

PSME-MCN-QUCH2/POMU1

Pseudotsuga menziesii-mixed conifer-Quercus chrysolepis/Polystichum munitum

Douglas-fir-mixed conifer-canyon live oak/swordfern



Vegetation Summary Table

(Sample size: 7)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	23	100
QUCH2	canyon live oak	28	86
QUKE	black oak	21	100
CADE3	incense cedar	12	100
PIPO	ponderosa pine	13	100
PILA	sugar pine	10	100
Tree Understory Layer			
QUCH2	canyon live oak	3	100
CADE3	incense cedar	3	100
PSME	Douglas-fir	2	86
QUKE	black oak	1	71
PILA	sugar pine	4	57
ABCO	white fir	3	43
Shrubs			
RHRU	Sierra coffeeberry	1	43
PHLE4	mock orange	1	43
Herbs/Grasses			
POMU1	sword fern	1	100
GABO1	B. bedstraw	1	86
CAMU1	multi-stemmed sedge	2	57

Environment

Elev: 3800 (3000-4400)

Aspect: E, SE, S

Slope: 55% (35-75%)

Landfm: lower to mid-slopes

PASI: 266 (192-312)

Site Class: 2 (1-2)

FSSC: 3 (3-4)

Special: May occur in inner-gorges, landslide hazard.

Landscape Ecology and Environment: This type indicates humid sites, with shallow soils and limited rootability. Sites are moderately steep to steep, south or east-facing, lower to mid-slopes. Soils are shallow, with low A.W.C. Hard and massive or hard and fractured granitic or metamorphic bedrock underlies the soils. This type often occupies large areas in the landscape in large canyons. It is bounded on drier sites by the PIPO-MCN-QUCH2/GABO1 association.

Vegetation:

Late seral forest are characterized by a relatively open conifer overstory, canyon live oak in a low midstory or regeneration layer, and sword fern in the herb layer. Douglas-fir and ponderosa pine co-dominate the overstory. Sugar pine, white fir, and incense cedar are often minor associates. Black oak is often a minor component or midstory co-dominant. The amount of canyon live oak in the midstory increases with increasing severity of the site. Canyon live oak indicates a hot, dry site with shallow effective rooting depth. Regeneration is co-dominated by canyon live oak, incense cedar, white fir, and Douglas-fir. Some of the highest sugar pine regeneration densities were seen in this type. Ponderosa pine regeneration was observed in some plots.

The herb and shrub layers are sparse, with a mixture of dry and moist site indicators. Shrubs are usually absent. Sword fern dominates the sparse herb layer, indicating humid sites. Bolander's bedstraw, indicating dry sites, and starflower, indicating moist sites, occur together. This mixture and the sword fern suggest sites intermediate between moist and dry.

Fire Ecology:

Either charred logs or fire scars were observed on all plots in this type. The topographic position, aspect, and steep slopes suggest a natural fire regime of moderately frequent fires with a mosaic of low intensity and medium or high intensity fires.

Productivity and Management:

Timber productivity is moderate to low, with some trees with high site class growing in bedrock fractures. Low stocking occurs on soils with high surface stones and rock outcrops. Limiting soils, steep slopes, and the tendency to occur in inner gorges make this type unsuitable for intensive forest management. Roots are important in maintaining slope stability. High coarse fragments and steep slopes will make reforestation difficult. It is important to maintain soil cover with any management activity, to ensure long-term productivity. Black oak is often present, providing deer holding areas and migratory corridors. Large raptors associated with adjacent rivers hunt in this type and band-tailed pigeons, doves, and grosbeaks are likely to occur. The open canopy with few large conifers makes this type marginally suitable for spotted owl foraging or pine marten or fisher travel corridors.

PIPO-MCN-QUCH2/CHFO2

Pinus ponderosa-mixed conifer-Quercus chrysolepis/Chamaebatia foliolosa

Ponderosa pine-mixed conifer-canyon live oak/bearclover

Vegetation Summary Table

(Sample size: 10)

		Cover	Cons
Tree Overstory Layer			
PIPO	ponderosa pine	24	100
QUCH2	canyon live oak	24	100
CADE3	incense cedar	17	100
QUKE	black oak	13	90
PILA	sugar pine	14	70
PSME	Douglas-fir	17	60
Tree Understory Layer			
QUCH2	canyon live oak	7	100
CADE3	incense cedar	3	80
PILA	sugar pine	1	70
ABCO	white fir	2	60
QUKE	black oak	2	50
PSME	Douglas-fir	11	40
PIPO	ponderosa pine	2	30
Shrubs			
CHFO2	bearclover	25	100
Herbs/Grasses			
GABO1	B. bedstraw	1	100
CAMU1	multi-stemmed sedge	1	100
IRI	iris species	2	60
HIAL	hawkweed	1	50
POCO6	milkwort	3	40

Environment

Elev: 4300 (3000-4900)

Aspect: S, SW, E

Slope: 52% (27-86%)

Landfm: upper to mid-slope

PASI: 282 (206-216)

Site Class: 1 (1-3)

FSSC: 2 (2-3)

Special: May occur above inner gorges; high landslide hazard.

Landscape Ecology and Environment: This type indicates hot, dry sites that are transitional between PIPO-MCN/CHFO2/GABO1 and the MCN-QUCH2 associations. Sites are moderately steep to steep, south-facing, upper or mid-slopes. Soils are moderately deep, usually with high coarse fragments. Substrates are metamorphic or volcanic. Solar insolation is high. This association may actually be a broad ecotone between the PIPO-MCN/CHFO2 and MCN-QUCH2 groups. However, it occurs in large areas in the landscape, sufficient to map.

Vegetation:

Late successional stands are characterized by an open, often scattered conifer overstory, canyon live oak in the midstory and regeneration layers, and bearclover in the shrub layer. Canyon live oak indicates hot, dry, and soil limiting growing conditions. Ponderosa pine and incense cedar co-dominate the overstory. Douglas-fir and sugar pine are common minor or occasionally co-dominant associates. Black oak and canyon live oak form a well developed lower midstory. Canyon live oak usually dominates the regeneration, but Douglas-fir, incense cedar and black oak are also well represented. Ponderosa pine and sugar pine regeneration occurs frequently but in low amounts.

Bearclover indicates dry, sunny sites and dominates the understory, forming dense patches. Herbs and graminoids are variable in cover and richness, with best representation in open areas between bearclover patches. Dry site indicators are prevalent, including Bolander's bedstraw, milkwort, Lemmon's campion, woolly sunflower, and Hartweg's iris.

Fire Ecology:

The topographic position and aspect suggest a natural fire regime of high frequency, light intensity fires. Bole scars and charred logs occur in this type, indicating past fire, however, frequency of scars or charring was less than expected.

Productivity and Management:

Productivity is generally low in this type with low stocking. This type is not suitable for intensitive managment. Occasional large trees with a high site class are found growing in small pockets of deeper soil, however, these areas are highly susceptable to mass wasting with vegetation removal. Light management using natural regeneration may be feasible, but this type is more suitable for other management objectives than timber. Road building may be difficult through associated rock outcrops. When black oak is present in sufficient amounts, this type can provide good deer winter foraging habitat. Marginal spotted owl foraging or fisher travel corridor might occur on sites with dense oak midstories. The sensitive plant, Pleasant Valley mariposa lily, may occur in openings in this type.

PIPO-MCN-QUCH2/GABO1

Pinus ponderosa-**mixed conifer**-Quercus chrysolepis/Galium bolanderi

ponderosa pine-mixed conifer-canyon live oak/Bolander's bedstraw

Vegetation Summary Table

(Sample size: 13)

		Cover	Cons
Tree Overstory Layer			
PIPO	ponderosa pine	29	92
PSME	Douglas-fir	42	77
QUKE	black oak	26	77
QUCH2	canyon live oak	21	69
CADE3	incense cedar	13	54
PILA	sugar pine	9	43
Tree Understory Layer			
QUKE	black oak	3	92
PSME	Douglas-fir	7	77
QUCH2	canyon live oak	5	77
PIPO	ponderosa pine	2	77
CADE3	incense cedar	3	69
PILA	sugar pine	4	62
Shrubs			
TODI	poison-oak	9	62
Herbs/Grasses			
GABO1	B. bedstraw	3	92
IRI	iris species	2	69
POCO6	milkwort	3	54

Environment

Elev: 3100 (2500-4400)

Aspect: SW, S, E

Slope: 44% (25-62%)

Landfm: upper, mid-, lower slopes

PASI: 254 (149-315)

Site Class: 2(1-2)

FSSC 3(2-4)

Special: May occur above inner gorges; high landslide hazard.

Landscape Ecology and Environment:

The PIPO-MCN-QUCH2/GABO1 association indicates hot, dry, exposed sites. It occurs on southwest or east-facing, moderately steep to steep, upper or mid-slopes. Solar insolation is high. Soils are typically moderately deep, with gravelly or sandy textures. Substrates are variable, including volcanic, granitic, and sedimentary bedrock types.

Vegetation:

Late seral stands are typified by open forests with a conifer overstory, canyon live oak or interior live oak in the midstory and regeneration, and Bolander's bedstraw in the herb layer. Ponderosa pine and Douglas-fir typically co-dominate the overstory. Incense cedar, sugar pine, and rarely white fir are minor associates. Black oak often occurs in high cover in the midstory, along with variable amounts of canyon live oak. Canyon live oak indicates hot, dry sites, usually with limited effective rooting. Douglas-fir and canyon live oak co-dominate the regeneration. Ponderosa pine and sugar pine regeneration are frequent but in low amounts. Incense cedar regeneration is variable, but generally low in amount. An uncommon tree, California nutmeg, was observed on several plots.

Poison-oak is usually present in varying amounts in the shrub layer, indicating very hot, low elevation sites. Deerbrush is also common in low amounts. The herb and graminoid layer is moderately well developed and often comprised of numerous dry site species, including Bolander's bedstraw, milkwort, iris, dogbane, and morning glory. Moderate site indicators including white-flowered hawkweed, multi-stemmed sedge, and red fescue are also common.

Fire Ecology:

The topographic position and typical aspect of this type suggests a mostly frequent, low intensity fire regime. Although some of the sites on lower slopes, or east-facing slopes might have had a somewhat lesser frequency. Some type of fire evidence, ranging from fire scars to charred bark or charcoal in the soil, was observed in all but one of the plots in this type.

Productivity and Management:

Timber productivity is low in general, although site class may be moderate due to trees growing in pockets of deep soil. Lithic soils and high coarse fragments cause low stocking. Timber management should be restricted to options that provide overstory shelter which is important for providing temperature control for successful artificial regeneration. Black oak provides transitional range for deer. Sites with higher canopy cover may provide foraging habitat for spotted owls or marginal travel corridors for fisher and pine marten. The sensitive plant, Tracy's sanicle, may occur in this type on the Lassen National Forest.

MIXED CONIFER EVERGREEN SHRUB GROUP

Distribution and Environment: The plant associations in the mixed conifer evergreen shrub group occur throughout the Sierra Nevada and other montane areas of California. These types occur at higher elevations in the mixed conifer zone or on harsh sites (nutrient imbalance or shallow soils).

Five plant associations are described in the mixed conifer evergreen shrub group including ABCO-MCN/CHSE2, ABCO-MCN/ACCI-CHSE2, PIPO-MCN/QUVA serpentine, PSME-MCN/QUVA, and PIPO-MCN/QUCHN-QUVA types. The PIPO-MCN/QUVA serpentine phase is found on serpentine substrates, and the PSME-MCN/QUVA type occurs on shallow and often skeletal soils developed from metasedimentary substrate (i.e. Deadwood soils). The PIPO-MCN/QUCHN-QUVA type is restricted to granitic rock outcrops. The ABCO-MCN/CHSE2 occurs most often at higher elevations in the mixed conifer zone. Another plant association, PIPO-MCN/ARC, has been mapped extensively but is not described here. It occurs on shallow, volcanic soils. The description can be found in the Camp Creek, Ecological Unit Inventory report. The PIPO-MCN/QUCHN-QUVA, ABCO-MCN/ACCI-CHSE2, and PSME-MCN/QUVA types are undersampled and therefore are only described in the Appendix.

Vegetation:

The plant associations in this group are highly varied in species composition and structure. The ABCO-MCN/CHSE2 and ABCO-MCN/ACCI-CHSE2 have high canopy covers, often very layered. The PIPO-MCN/QUVA serpentine, PSME-MCN/QUVA, PIPO-MCN/QUCHN-QUVA and PIPO-MCN/ARC types have very open canopies, with little layering. Overstory canopy closure in these types are typically less than 40%. The tree composition in these latter types is often dominated by ponderosa or even Jeffrey pine. Sugar pine can be a localized major component. White fir and Douglas-fir are sometimes present and Douglas-fir is occasionally dominant. The shrub and herb layers are variable, but other evergreen shrubs or herbs are also typical such as western prince's pine and pinemat manzanita.

Fire Ecology:

The natural fire regimes of these types is variable. Refer to the individual descriptions for more detail, since overall generalizations are difficult to make.

Productivity and Management:

The ABCO-MCN/CHSE2 and ABCO-MCN/ACCI-CHSE2 are both moderately to highly productive. The other types are non-commercial or only suited for light management. The PIPO-MCN/QUVA serpentine, the PIPO-MCN/QUCHN-QUVA, PSME-MCN/QUVA, and PIPO-MCN/ARC types may have individual trees with high site class, but stocking potential is very low and soils are generally sensitive to

management. The ABCO-MCN/CHSE2 and ABCO-MCN/ACCI-CHSE2 types have dense canopies and often layered structures providing good habitat for late seral dependent arboreal wildlife. The other types have very open canopies, with a resulting common component of black oak. The presence of black oak provides transition or foraging habitat for deer. Foraging by raptors for rodents in these open sites has also been observed.

PIPO-MCN/QUVA (serpentine)

Pinus ponderosa-mixed conifer/Quercus vaccinifolia
ponderosa pine-mixed conifer/huckleberry oak

Vegetation Summary Table
(Sample size: 6)

		Cover	Cons
Tree Overstory Layer			
CADE3	incense cedar	13	100
PILA	sugar pine	16	83
PIPO	ponderosa pine	18	67
ABCO	white fir	12	67
PSME	Douglas-fir	24	50
PIJE	Jeffrey pine	10	33
Tree Understory Layer			
CADE3	incense cedar	3	100
PILA	sugar pine	1	100
ABCO	white fir	4	83
PSME	Douglas-fir	2	67
PIJE	Jeffrey pine	2	33
Shrubs			
QUVA	huckleberry oak	55	100
AMUT	serviceberry	2	100
ARNE2	manzanita	25	67
CEPR	squaw carpet	9	67
RHRU	coffeeberry	2	67
Herbs/Grasses			
GABO1	B. bedstraw	1	100
IRHA	Hartweg's iris	2	83
CHUM	w.prince's pine	2	67
APO	dogbane	1	50

Environment

Elev: 4900 (3500-5800)

Aspect: NW, E, SE

Slope: 26% (10-70%)

Landfm: mid- to upper slopes

PASI: 247 (219-276)

Site Class: 2 (2-3)

FSSC 4 (3-4)

Landscape Ecology and Environment: This type indicates moderately deep, serpentine derived soils. Aspects are variable, ranging from northwest to east or south-east. Slopes are also variable but topographic position is usually upper to mid-slopes. Solar insolation is high. The area occupied on the landscape varies with the size of the serpentine formation.

Vegetation:

Late seral forests are characterized by an open conifer overstory of mid-sized trees and a well developed shrub layer dominated by huckleberry oak. The conifer overstory is composed of varied mixtures of sugar pine, incense cedar, white fir, Douglas-fir, ponderosa pine, and Jeffrey pine. Few layers occur. Conifer regeneration is similarly diverse but with pine species scattered in occurrence.

Huckleberry oak dominates a well developed and diverse shrub layer. Most of the shrub species indicate open, dry or nutrient limiting conditions and include squaw carpet, pinemat manzanita, and serviceberry. The herb layer is comprised of dry, open site indicator species, often in diverse combinations. Some of the more prevalent species include Bolander's bedstraw, Hartweg's iris, multi-stemmed sedge, dogbane, western fescue, and wavy-leaved paintbrush.

Fire Ecology:

The topographic position and aspect of this type is variable, depending more on the location of the serpentine substrate than the microclimate of the site. However, sites were consistently on mid to upper slopes, suggesting frequent low intensity fires, except perhaps on north-facing slopes. There was fire evidence on approximately half of the plots, including cat-face fire scars and charred bark. Generally, only a few of the trees were scarred, suggesting that fuel loading is not typically high enough to maintain a wide-spreading fire. Although fuel loading is low, and fuel ladders not present, huckleberry oak may serve as a heat sink, resulting in more intense fires especially on south-facing slopes.

Productivity and Management:

Timber productivity is low in this type, due to low natural stocking. Individual trees may have a moderate site class but there are not sufficient numbers of them to make this type suitable for intensive management. Limited management with longer rotations and maintenance of natural regeneration would be most suitable. The open canopy of this type may provide suitable foraging habitat for spotted owl. Deer forage is generally low, but this type could provide suitable transition range. The sensitive plant, Constance's rock cress, may occur in this type.

ABCO-MCN/CHSE2

Abies concolor-**mixed conifer/**Chrysolepis sempervirens
white fir-mixed conifer/bush chinquapin

Vegetation Summary Table
(Sample size: 11)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	55	100
PILA	sugar pine	18	91
CADE3	incense cedar	17	91
PIPO	ponderosa pine	24	55
PSME	Douglas-fir	13	55
Tree Understory Layer			
ABCO	white fir	6	100
CADE3	incense cedar	4	91
PILA	sugar pine	2	82
PSME	Douglas-fir	1	45
Shrubs			
CHSE2	b. chinquapin	30	100
SYMO	cr. snowberry	2	73
Herbs/Grasses			
CHME2	prince's pine	100	1
PYPI	w-veined wintergreen	73	1
CAMU1	multi-stemmed sedge	1	58
CHUM	w. prince's pine	6	50
CARO1	Ross' sedge	3	58

Environment

Elev: 5500 (4800-6200)

Aspect: Variable, E, W

Slope: 31% (10-55%)

Landfm: mid-slopes (upper, lower slopes)

PASI: 253 (179-297)

Site Class: 2 (1-3)

FSSC 3 (2-4)

Landscape Ecology and Environment: This type occurs at high elevations within the mixed conifer zone in the northern Sierra Nevada and southern Cascade mountains. Sites are on slopes, primarily mid-slopes, with aspects varying from east to northwest. Soils are moderately deep to deep, developed on volcanic or granitic substrates. Coarse fragments are variable, but often high. The ABCO-MCN/CHSE2 association generally occupies small areas on the landscape, or over extensive areas in small patches.

Vegetation:

Late successional forests are characterized by a conifer overstory dominated by white fir and bush chinquapin in the shrub layer. Although white fir dominates the overstory, incense cedar is a consistent minor component and sugar pine, ponderosa pine, Douglas-fir, and Jeffrey pine are commonly present in low amounts. White fir dominates the regeneration, with incense cedar, and sugar pine common, but in low amounts.

The shrub layer varies in cover, increasing with canopy openings. Bush chinquapin dominates the patchy shrub layer. Creeping snowberry commonly occurs in low amounts. The herb and graminoid layer is poorly developed, with scattered western prince's pine, Ross' sedge, and multi-stemmed sedge with low cover.

Fire Ecology:

The natural fire regime of this type is likely variable, due to the typical topographic position on mid-slopes on east to northwest aspects. White fir comprises only a portion of the largest diameter trees, suggesting that previously fire was fairly frequent in these sites. The scattered presence of large white fir indicates that fire spread was uneven and of low intensity, resulting in a mosaic effect.

Productivity and Management:

Productivity is generally moderately high, with moderate site class and high stocking. There are few silvicultural limitations. Coarse fragments in the soil tend to be moderately high, causing some difficulty with equipment or planting operations. Competition from bush chinquapin varies with the amount present on the site, since it does not seem to seed in rapidly. Manzanita and whitethorn can form dense shrubfields mixed with bush chinquapin when sites are heavily distributed or burned intensely. Suitable species for reforestation are white fir, sugar pine, and ponderosa pine or Jeffrey pine, depending on elevation. Douglas-fir may be appropriate at lower elevations. Natural regeneration is often good but may take time to establish.

The mosaic structure of small openings of bush chinquapin and other shrubs within a matrix of moderately dense overstory provides good thermal cover and browse opportunity for deer. Spotted owls may use areas of dense canopy. The sensitive plant, close-throated beardtongue, may occur in this type.

MIXED CONIFER-DRY HERB GROUP

Distribution and Environment: The varied plant associations that occur on drier sites within the mixed conifer zone are distributed throughout the northern Sierra Nevada and southern Cascades. These plant associations lack a consistent floristic basis to tie them together but they are related in their ecology, environment and management interpretations.

The mixed conifer-dry herb group occurs on sites with high solar insolation, on south-facing slopes or convex slopes. Soils are often shallow or rocky but may be moderately deep. Bedrock varies from volcanic to metasedimentary or granitic. The topographic position is more likely upper to mid-slope or ridgetop.

Three plant associations are described in the mixed conifer-dry herb group. The PIPO-MCN/ANRO-ERNU3 type is found on granitic substrates, primarily in transition to eastside pine. The PSME-MCN/AMUT type occurs on shallow soils on metasedimentary substrates. The PIPO-MCN/GABO1-POCO6 plant association is the most widespread, found on varied, but mostly volcanic substrates. The PIPO-MCN/ANRO-ERNU3 type is undersampled and, therefore, is described only in the appendix.

Vegetation:

Forest structure is varied but typically has an open overstory canopy with few layers present. The understory is mostly sparse or patchy but may be diverse.

Ponderosa pine or Jeffrey pine (at higher elevations) dominate the overstory. Sugar pine, Douglas-fir, and incense cedar occur in varied mixtures in the overstory. White fir is often present in the midstory or regeneration layers, indicating a more recent occupancy . Pine regeneration is present in most of the dry herb group plant associations but not consistently.

The sparse understory is a reflection of the dry sites that these plant associations occupy. Shrubs are frequently absent, with serviceberry or snowberry most common when present. The herb layer is comprised of dry site herbs, with small and/or very pubescent leaves. Species diversity is variable, ranging from few or no herbs to a rich mixture of annuals and perennials.

Fire Ecology:

The plant associations in the mixed conifer dry herb group have probably been changed more as a result of fire suppression than other types. Because of their prevalence on south-facing upper slopes or ridgetops with high solar insolation and resulting dry conditions, the natural fire regime would have included frequent low intensity fires. This is well supported by the dominance of fire resistant species (ponderosa pine, Jeffrey pine, sugar pine, incense cedar, and Douglas-fir) in the large

diameter classes. White fir is conspicuously absent from most plots in the large diameter classes, but is dense in the smaller size classes, indicating a recent increase since fire suppression.

Productivity and Management:

Productivity is primarily moderate to low, varying mostly with soil characteristics. Sites with moderately deep to deep soils support Dunning's site classes of 2 or 3, or less commonly 1 or 1A. Other sites with shallower soils have low productivity, either with low site classes of 4 or 5 or moderate site classes and low stocking.

On shallower soils, litter cover is often irregular, resulting in moderate to high erosion potential. Surface and A-horizon rock is often moderate to high, decreasing plantability. The soil characteristics in combination with high solar insolation may slow regeneration. Seral stage development is also slower.

The generally lower canopy cover and layering results in low suitability for wildlife travel corridor or habitat for interior-dependent species. The overstory may provide forage for game.

PIPO-MCN/GABO1-POCO6

Pinus ponderosa-mixed conifer/Galium bolanderi-Polygala cornuta
ponderosa pine-mixed conifer/Bolander's bedstraw-milkwort

Vegetation Summary Table
(Sample size: 25)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	32	92
PIPO	ponderosa pine	32	84
CADE3	incense cedar	25	80
PILA	sugar pine	17	76
PSME	Douglas-fir	23	68
QUKE	black oak	7	60
Tree Understory Layer			
ABCO	white fir	5	92
CADE3	incense cedar	3	80
QUKE	black oak	1	80
PILA	sugar pine	2	76
PSME	Douglas-fir	2	60
PIPO	ponderosa pine	1	36
Shrubs			
SYMO	cr. snowberry	2	60
Herbs/Grasses			
GABO1	B. bedstraw	1	84
HIAL	white-flwrd. hawkweed	1	52
CAMU1	multi-stemmed sedge	1	48
IRI	iris species	1	44
POCO6	milkwort	2	28

Environment

Elev: 4600 (2200-5900)
Aspect: SW, SE, E
Slope: 37% (1-65%)
Landfm: upper to mid-slopes, ridges
PASI: 262 (162-311)
Site Class: 2 (1A-2)
FSSC 3 (2-4)

Landscape Ecology and Environment:

This type indicates dry, warm or hot sites with moderately deep to deep soils. Sites are south or west-facing, ridges or upper to mid-slopes, typically convex areas. Solar insolation is high. Soils are mostly moderately deep, with low to moderate A.W.C., developed from mainly volcanic and metamorphic substrates. Coarse fragments are generally moderate to high. The PIPO-MCN/GABO1-POCO6 association often occupies large areas in the landscape alone or in complex with PIPO-MCN/CHFO2/GABO1. Because it is so widespread, it may occur adjacent to many types.

Vegetation:

Late seral forests have open or moderately dense conifer overstories, and Bolander's bedstraw or milkwort and other dry site indicators in a sparse herb layer. Ponderosa pine, sugar pine, incense-cedar, and occasionally Douglas-fir, co-dominate the overstory in varied mixtures. White fir is a minor associate in the highest overstory layers, but is prevalent in the midstory since fire suppression. Regeneration is mostly dominated by white fir and incense cedar, or sometimes by Douglas-fir. Ponderosa pine regeneration often occurs in low amounts and likely would have been higher under a natural fire regime.

The shrub layer is sparse or absent, sometimes with scattered creeping snowberry. The herb layer is comprised of scattered dry and moderate site indicators. Dry site indicators include Bolander's bedstraw, milkwort, iris, dogbane, and *Silene* species. Moderate site indicators include white-flowered hawkweed, kelloggia, multi-stemmed sedge, and Ross' sedge.

Fire Ecology:

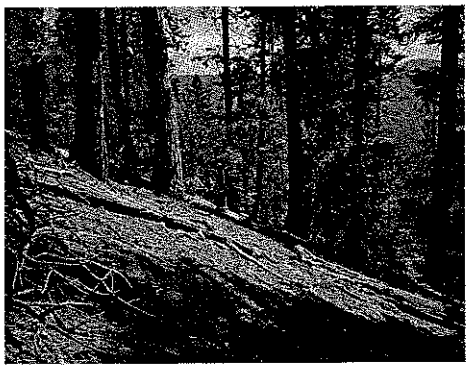
The structure and species composition of this type has probably been significantly altered with fire suppression. The topographic position on south or west-facing ridges or mid to upper slopes, suggests a natural fire regime of frequent, low intensity, wide spreading fires. This type of regime is supported by the dominance of fire resistant pines, incense-cedar, and Douglas-fir in the large diameter classes. White fir is most prevalent in the midstory and regeneration layers, indicating an increase following fire suppression.

Productivity and Management:

Dry conditions with generally good soils result in moderate productivity in this type; site class and stocking are most often moderate. Silvicultural options are generally open on most sites, although areas with higher soil coarse fragments and steeper slopes are more sensitive to ground disturbance. On harsher sites, maintenance of soil cover and organic material is critical for retaining long-term productivity. Open understories and presence of black oak can provide foraging habitat for deer and goshawk.

PSME-MCN/AMUT

Pseudotsuga menziesii-mixed conifer/Amelanchier utahensis
Douglas-fir-mixed conifer/serviceberry



Vegetation Summary Table
(Sample size: 10)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	19	100
PSME	Douglas-fir	35	90
PILA	sugar pine	17	90
CADE3	incense cedar	12	90
PIPO	ponderosa pine	24	80
QUKE	black oak	21	40
Tree Understory Layer			
CADE3	incense cedar	2	100
PILA	sugar pine	2	100
ABCO	white fir	3	90
PSME	Douglas-fir	3	80
QUKE	black oak	1	70
PIPO	ponderosa pine	2	50
Shrubs			
AMUT	serviceberry	2	100
SYMO	cr. snowberry	3	50
Herbs/Grasses			
GABO1	B. bedstraw	1	90
FERU	red fescue	3	80
HIAL	white-flw. hawkweed	1	80
CAMU1	multi-stemmed sedge	1	60
SAGR	sierra sanicle	2	40
ARCO3	heart-leaved arnica	2	40

Environment

Elev: 4400 (3500-5200)

Aspect: SE, NW

Slope: 37% (5-70%)

Landfm: ridges, upper to mid-slopes

PASI: 234 (165-300)

Site Class: 3 (1-4)

FSSC 5 (2-5)

Special: high bare ground or rock cover

Landscape Ecology and Environment: This type indicates dry sites with shallow soils and high surface rock. Sites are southeast, east, west, or northwest facing, moderately steep to steep, mid to upper slopes or ridges. Solar insolation is high. Soils are shallow, with low A.W.C.'s, developed primarily on schist substrate. It usually occupies small or medium size areas in the landscape.

Vegetation:

Late seral forests are characterized by an open conifer overstory and a sparse understory with serviceberry in the shrub layer and/or Sierra sanicle or lupine in the herb layer. Ponderosa pine often dominates or co-dominates the overstory along with sugar pine, incense-cedar, and Douglas-fir. White fir sometimes occurs as a minor component of the upper overstory, but is prevalent in the midstory and regeneration layers. Black oak is common in the midstory. Regeneration is co-dominated by white fir, Douglas-fir and incense cedar. Sugar pine and ponderosa pine regeneration are common in low amounts.

The shrub layer is sparse, but usually comprised of several species including snowberry, serviceberry or wild rose. Scattered disturbance indicators persist in the open canopy of late seral stands including greenleaf manzanita, deerbrush, and sierra gooseberry. The herb layer is often diverse, with dry, sunny site indicators prevalent, including Sierra sanicle, mariposa lily, *Silene* species, heart-leaved arnica, and Shelton's violet. Other common dry or moderate site indicators are Bolander's bedstraw, white-flowered hawkweed, red fescue, and multi-stemmed sedge.

Fire Ecology:

The topographic position and aspect of this type suggests a natural fire regime of frequent or medium frequency, low intensity fires. Fire spread is uneven due to low productivity (lower fuel accumulations) and high surface rock cover (low litter cover). Fire evidence of charred bark or fire scars on a few trees was observed on all but one plot in this type.

Productivity and Management:

Timber productivity is low on these sites, due to the shallow, skeletal soils. Individual trees may have a high site class where they are occupying fractures in the bedrock or small pockets of better soils, but stocking potential is low. This type is not suitable for intensive management. Artificial regeneration is not reliable; any vegetation management should emphasize natural regeneration. To maintain long-term productivity, maintenance of organic material (litter and downed logs) is critical. Erosion hazard is high. When black oak is present, forage for deer and squirrels is provided. Madrone provides forage for band-tailed pigeons. The sensitive plants, Quincy lupine and Tracy's sanicle, may be present.

MIXED CONIFER-MOIST HERB GROUP

Distribution and Environment: The varied plant associations that occur on moist sites within the mixed conifer zone occur throughout the northern Sierra Nevada and southern Cascades. Although these plant associations do not have a consistent floristic relationship, they are related in their ecology and thus management interpretations.

Most sites are on cooler, moister locations. Elevation is variable, but aspect tends to be north or east-facing on upper slopes. On lower slopes or ravines, aspect is variable. These plant associations may occur in or near riparian or headwater areas. Humidity and soil moisture may be less than in the mountain dogwood subseries, although data is not available to confirm this.

Four plant associations are described in the mixed conifer-moist group including PSME-MCN/COCOC, ABCO-MCN/ADBI, ABCO-MCN/SMRA-DIHO2, PSME-MCN/TRLA3. These plant associations are listed in order of a gradient from the most moist to the least moist. This is a relative listing, since all are considered indicative of moist sites.

Vegetation:

A multi-layered conifer canopy is typical. Overstory tree cover is generally high. The understory varies from dense to sparse, related to openings in the overstory canopy and soil moisture.

The conifer layers are comprised of varied mixtures of Douglas-fir, white fir, sugar pine and ponderosa pine. Incense cedar is frequently a minor component. Ponderosa pine is more prevalent in the overstory of the less moist types, ABCO-MCN/SMRA-DIHO2 and PSME-MCN/TRLA3, however it rarely regenerates in late seral stands. Pacific yew is occasionally present in the two moister types, but usually in the understory, indicating marginal habitat. California nutmeg may also occur. Dogwood may be present, but in low amounts.

The understory is best developed and most diverse in the moister types, PSME-MCN/COCOC and ABCO-MCN/ADBI. Hazelnut indicates more humid air, occurring more frequently near surface water. The understory of PSME-MCN/TRLA3 is often patchy, with patches of herbs in canopy gaps.

Fire Ecology:

The natural fire regime of the mixed conifer-moist group is likely variable. The moister types probably had a regime of low to medium frequency, low intensity fires. The spread of the fires would have been irregular due to the generally moist conditions in the understory. The less moist plant associations, PSME-MCN/TRLA3 and ABCO-MCN/SMRA-DIHO2 sometimes occupy upper north-facing slopes or moist ravines on south-facing slopes. Under a natural fire regime, the

frequency of fire might have been medium frequency or high frequency, but with an uneven fire spread (mosaic). This is supported by the presence of both white fir and ponderosa pine in the overstory of these latter types and the observation of moderately frequent cat-face scars on the large live trees.

Productivity and Management:

Productivity is generally high to moderate in this plant association group, with high basal areas and Dunning's site classes of 1A, 1 and 2 most common. On moister sites with shallower or rockier soils, site classes of 3 or 4 may occur. Even with this variation in site class, stocking and canopy cover is consistently high. The lower site classes differ most notably in the longer time required to develop to later seral stages.

The high overstory canopy covers and dense stocking make these plant associations highly suitable for wildlife travel corridors and habitat for interior-dependent species. Thermal cover is generally good. Currently vertical canopy diversity is evenly distributed throughout stands, but under a natural fire regime, a mosaic pattern of small aggregates is likely.

These plant associations sometimes occupy the headwaters of drainages or alluvial plains of seasonal streams, indicating potentially sensitive hydrologic conditions.

PSME-MCN/COCOC

Pseudotsuga menziesii-mixed conifer/Corylus cornuta californica

Douglas-fir-mixed conifer/hazelnut

Vegetation Summary Table

(Sample size: 15)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	53	93
ABCO	white fir	26	80
CADE3	incense cedar	14	80
PILA	sugar pine	13	80
PIPO	ponderosa pine	17	60
TABR	Pacific yew	1	7
Tree Understory Layer			
ABCO	white fir	4	87
QUKE	black oak	1	87
PSME	Douglas-fir	4	80
CADE3	incense cedar	13	67
PILA	sugar pine	2	47
TABR	Pacific yew	2	13
TOCA	California nutmeg	1	7
Shrubs			
COCOC	hazelnut	4	100
SYMO	cr. snowberry	3	53
Herbs/Grasses			
ADBI	trail plant	12	73
TRLA3	starflower	12	67
OSCH	sweet-cicely	3	67
FEOC	western fescue	2	47
DIHO2	fairy bells	1	47

Environment

Elev: 3800 (2100-4800)

Aspect: N, NE, NW, (SE)

Slope: 38% (12-80%)

Landfm: mid- to lower slopes

PASI: 227 (125-311)

Site Class: 1A (1A-1)

FSSC 2 (1-2)

Special: May be near riparian a

Landscape Ecology and Environment:

This type indicates cool, moist sites with humid air in the mixed conifer zone. The environment is very similar to the closely related PSME-MCN-CONU2/COCOC association, occurring on north or northeast-facing, gentle to moderately steep lower or mid-slopes. Sites are often adjacent to perennial streams and generally occupy small areas in the landscape. Soils are moderately deep to deep on metamorphic or volcanic substrates. Coarse fragments tend to be higher in this type.

Vegetation:

Late seral forests are characterized by a dense, multi-layered conifer overstory, hazelnut in the shrub layer, and dense patches of trail plant and/or starflower in the herb layer. Douglas-fir dominates the overstory, or occasionally co-dominates the overstory with white fir. Douglas-fir indicates cool, moist conditions within the mixed conifer zone. Incense cedar, sugar pine, and occasionally ponderosa pine are minor associates. Pacific yew or California nutmeg occur infrequently. Douglas-fir dominates the regeneration, but white fir and incense cedar regeneration is also high and sometimes dominant. Black oak, sugar pine, and mountain dogwood regeneration are common in low amounts. Canyon live oak occurs scattered in the overstory and/or midstory on sites with limiting soil conditions, either shallow and rocky sites with limited rootability or very high coarse fragments.

Hazelnut forms a tall but variable shrub layer, indicating cool, moist, humid sites near running water. The herb layer is well developed, including an often rich mixture of moist site indicators. Dense patches of trail plant or starflower dominate the herb layer with Hooker's fairy bells, western fescue, sweet-cicely, California harebell, false Solomon's seal, queen's cup, and fragrant bedstraw also present.

Fire Ecology:

The north trending aspects and topographic positions of this type suggest a natural fire regime of relatively infrequent, low intensity or medium intensity, variable spread fires. All but one plot had visible evidence of fire, but it consisted mostly of individual scarred trees or charred bark, snags or logs.

Productivity and Management:

High available water, cool moist air, and generally good soils result in high timber and shrub productivity in this type. Silvicultural options are generally open, although on some sites localized areas of high water table may occur and the type tends to occur adjacent to riparian areas. Stocking control and maintaining species diversity will avoid potential pathogen problems. The multi-layered, dense overstory provides quality habitat for late seral dependent species including spotted owl, pine marten, and fisher. Sites with black oak provide cover and forage for deer.

ABCO-MCN/ADBI

Abies concolor-**mixed conifer/**Adenocaulon bicolor
white fir-mixed conifer/trail plant

Vegetation Summary Table
(Sample size: 27)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	52	100
CADE3	incense cedar	25	96
PILA	sugar pine	16	88
PSME	Douglas-fir	37	77
PIPO	ponderosa pine	14	44
Tree Understory Layer			
CADE3	incense cedar	6	100
ABCO	white fir	4	96
PSME	Douglas-fir	2	74
PILA	sugar pine	1	63
TABR	Pacific yew	1	11
Shrubs			
SYMO	cr. snowberry	3	74
Herbs/Grasses			
ADBI	trail plant	6	100
OSCH	sweet-cicely	2	67
HIAL	hawkweed	2	59
SMRA	Solomon's seal	1	59
DIHO2	fairy bells	2	48
GATR	fr. bedstraw	2	41

Environment

Elev: 4700 (2800-6100)

Aspect: N, NE, NW

Slope: 26% (4-60%)
Landfm: lower slopes, bottoms
PASI: 229 (138-291)
Site Class: 1A (1A-2)
FSSC 2 (1-3)
Special: May occur in headwater or next to drainages.

Landscape Ecology and Environment: This type indicates cool, moist, gently sloping sites with typically well developed soils, at higher elevations. Sites are north-facing lower slopes, benches, or swales. It is often associated with headwater areas or seasonal streams. Soils are moderately deep to deep, formed from variable substrates. Coarse fragments vary widely, indicating that either available moisture from the soil (with low coarse fragments) or water from subsurface flow provides the primary environmental conditions for this type.

Vegetation:

Late successional forests are characterized by dense, several layered conifer overstories, and an herb layer dominated by trail plant. White fir, incense cedar, and frequently Douglas-fir co-dominate all layers of the diverse conifer overstory. Sugar pine is consistently a minor associate. Ponderosa pine sometimes occurs in low amounts. Regeneration is dominated by white fir and incense cedar, but Douglas-fir and sugar pine are frequent in low amounts. The white fir and Douglas-fir in the overstory and regeneration indicate cool, moist sites.

The shrub layer is variable, with no shrubs or variable amounts of snowberry. Trail plant dominates the usually well developed herb layer, indicating moist soils. Other moist site indicators may include false Solomon's seal, sweet-cicely, fragrant bedstraw, and Hooker's fairy bells. Western or red fescue are common.

Fire Ecology:

A natural fire regime of infrequent, low or medium intensity, variable spreading fire is suggested by the north aspects and typical lower slope topographic position. Only three plots had no evidence of fire, and the plots with fire evidence usually had a single scarred or charred tree or burned snag. Only one-third of the plots had several trees with fire scars indicating that fire does occur in this type, although it is generally patchy with few effects.

Productivity and Management:

Timber productivity is high with high site class and high stocking. Silvicultural options are generally open, although early season equipment operations should be limited due to high soil moisture and risk of compaction and puddling. Road locations should be examined on a site specific basis. Douglas-fir, white fir, sugar pine, and sometimes ponderosa pine are suitable reforestation species. Deerbrush may be a competition problem. High canopy cover and often multi-layered overstory provide suitable habitat for spotted owls, marten, and fisher. Amphibians may be present in association with moist logs, especially when adjacent to wet areas. On more open sites, suitable goshawk habitat may occur.

ABCO-MCN/SMRA-DIHO2

Abies concolor-mixed conifer/Smilacina racemosa-Disporum hookeri
white fir-mixed conifer/Solomon's seal-Hooker's fairybells

Vegetation Summary Table
(Sample size: 10)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	51	100
CADE3	incense-cedar	12	100
PILA	sugar pine	36	80
PIPO	ponderosa pine	11	70
PSME	Douglas-fir	33	70
Tree Understory Layer			
ABCO	white fir	2	100
CADE3	incense-cedar	3	80
PSME	Douglas-fir	1	60
QUKE	black oak	1	60
PILA	sugar pine	1	40
Shrubs			
SYMO	cr. snowberry	2	90
Herbs/Grasses			
SMRA	Solomon's seal	1	70
CHME2	princes' pine	1	70
PTAN	pine drops	1	60
DIHO2	fairy bells	1	50

Environment

Elev: 5000 (4100-5600)

Aspect: NE, E, NW

Slope: 35% (5-55%)

Landfm: upper, mid-slope

PASI: 226 (180-253)

Site Class: 1(1A-2),

FSSC 2(1-4)

Landscape Ecology and Environment:

This type indicates cool, dry to moist sites at mid to upper elevations in the mixed conifer zone. Sites are usually northeast or east facing, upper or midslopes. Soils are generally moderately deep, often developed on volcanic substrates. A.W.C.'s are moderate. It most often occupies large areas in the landscape or over large areas in a mosaic with moister types such as PSME-MCN-CONU2/ADBI or ABCO-MCN/ADBI.

Vegetation:

Late seral forests have a moderately dense to dense conifer overstory and a sparse understory with false Solomon's seal or Hooker's fairy bells. The overstory is often co-dominated by variable mixtures of white fir, incense cedar, sugar pine, and ponderosa pine. The lower overstory layers and the regeneration are dominated by white fir and/or incense-cedar, with sugar pine frequent in low amounts. Ponderosa pine regeneration is rare. Red fir occasionally occurs. The prevalence of white fir, incense-cedar, and sugar pine regeneration indicates cool conditions and dense overstories that these sites support.

False Solomon's seal or Hooker's fairy bell are the most prevalent components of the sparse understory, indicating cool sites. The absence of other moist site species indicates that these sites are relatively dry. Moderate site species occur sporadically including pine violet, western prince's pine, and kelloggia. Creeping snowberry and Sierra gooseberry also occur sporadically in low amounts.

Fire Ecology:

The typical topographic position of upper or midslopes on north-facing aspects suggest a variable fire regime under natural conditions. The highest frequency of fires for north-facing slopes would likely occur due to the proximity to fire prone ridgetops. A natural fire regime of frequent, low intensity, variable spread fires is probable. This is supported by the observation of fire evidence in most plots of this type, including a few trees with cat-face fire scars, but two plots with many fire scars. The frequent occurrence of fire resistant trees (sugar pine, ponderosa pine, incense-cedar) in the large diameter classes also support this proposed regime.

Productivity and Management:

Timber productivity is moderate to high, with moderate or high site class and high stocking. Silvicultural options are generally open although some sites have high coarse fragments that may limit plantability. Deerbrush or greenleaf manzanita might be competition problems if stands are opened, and especially with broadcast burning. Dense overstories with more open midstories provide flying access for goshawk foraging. This type is also suitable habitat for spotted owl foraging and for pine marten and fisher.

PSME-MCN/TRLA3
Pseudotsuga menziesii-mixed conifer/Trientalis latifolia
Douglas-fir-mixed conifer/starflower

Vegetation Summary Table
(Sample size: 17)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	37	100
PSME	Douglas-fir	31	100
CADE3	incense cedar	13	100
PILA	sugar pine	21	88
PIPO	ponderosa pine	22	76
QUKE	black oak	4	59
Tree Understory Layer			
CADE3	incense cedar	3	94
ABCO	white fir	6	88
PSME	Douglas-fir	2	88
PILA	sugar pine	2	71
QUKE	black oak	4	59
QUCH2	canyon live oak	2	53
TOCA	Ca. nutmeg	1	6
Shrubs			
SYMO	cr. snowberry	2	76
Herbs/Grasses			
TRLA3	starflower	4	100
IRI	iris species	2	76
VILO	pine violet	2	76
CAMU1	multi-stemmed sedge	1	71

Environment

Elev: 4600 (4200-5200)

Aspect: S, SW, E

Slope: 35% (5-55%)

Landfm: upper slopes, ridges (mid-slopes)

PASI: 242 (145-297)

Site Class: 2 (1A-2),

FSSC 3 (2-4)

Special: May occur in headwaters on dry slopes

Landscape Ecology and Environment:

This type indicates moderate to moist sites on ridges or upper slopes. Sites are often concave areas on south-facing slopes or saddles on ridges or relatively drier sites on north-facing slopes. Soils are moderately deep to deep, formed primarily on volcanic substrates. Coarse fragments are often moderate to high. It occupies small areas in the landscape usually in complex with drier types, such as PIPO-MCN/CHFO2/GABO1.

Vegetation:

Late seral forests have moderately dense conifer overstories and patches of starflower in the herb layer. A variable mixture of white fir, Douglas-fir, sugar pine, ponderosa pine, and incense-cedar co-dominate the upper layers of the overstory. Ponderosa pine and sugar pine often dominate the large diameter classes. Sugar pine, Douglas-fir, white fir, incense cedar, and black oak regeneration is frequent. Ponderosa pine regeneration was observed in several plots.

The shrub and herb layers are variable, but patches of starflower are often dominant, indicating moist, warm sites. Snowberry is the most prevalent shrub but with low cover. A scattered mixture of moderate, moist, and dry site herbs indicate that this type is transitional between moist and dry sites. Species include moderate site indicators: pine violet, kelloggia, and white-flowered hawkweed; moist site indicators: false Solomon's seal, Hooker's fairy bells; and dry site indicators: iris, milkwort, and Bolander's bedstraw.

Fire Ecology:

The typical topographic position of moister microsites on ridges or upper south, east or west facing slopes suggests a natural fire regime of frequent, low intensity, evenly spreading fires. This is well supported by the observed visible fire evidence. All but two plots had fire scars on at least one tree. Most plots had a few scarred trees and over half of the plots had many fire scarred trees. This regime is also supported by fire resistant species in the large diameter classes.

Productivity and Management:

Timber productivity is moderate with moderate site class and moderate to high stocking. Silvicultural options are open, except on limited sites with high coarse fragments. Ponderosa pine, Douglas-fir, and sugar pine are suitable reforestation species. Whitethorn and deerbrush are likely competitors. Sites with black oak provide transitional range for deer. The moderately dense overstory results in moderately suitable habitat for spotted owl foraging, fisher, and pine marten. Downy and hairy woodpeckers are likely to occur and bear may use this type.

MIXED CONIFER MODERATE GROUP

Distribution and Environment:

The plant associations in the moderate group lack consistent floristic similarities, but are found in similar environments and have shared ecological characteristics. The group most often occurs at high elevations in the mixed conifer zone or on sites that are not distinctly dry or moist at lower elevations.

Two plant associations are included in the moderate group. ABCO-MCN/CARO1 occurs at moderate to high elevations in the mixed conifer zone and may indicate areas of high snowpack. The ABCO-MCN/SYMO/KEGA has a similar distribution to the ABCO-MCN/CARO1 plant association. Both types are closely related to the white fir series. Several other plant associations in other subseries or groups may also fit in the moderate group including: ABCO-MCN/CHSE2, PSME-MCN/TRLA3, and ABCO-MCN/SMRA-DIHO2.

Vegetation:

A dense conifer overstory is typical in the moderate group. Canopy layering is sometimes limited by shading of the dense overstory. White fir is often dominant, with incense cedar, sugar pine and ponderosa pine typically occuring as minor components. In stands with previous extensive fire disturbance, ponderosa pine may dominate the overstory and white fir the midstory.

The shrub and herb layers are typically very sparse and species poor. Shade tolerant species such as Ross' sedge, multi-stemmed sedge, kelloggia or snowberry are most common.

Fire Ecology:

This group has variable topographic positions but is typically located at higher elevations in the mixed conifer zone. The natural fire regime is likely similar to that of the white fir zone that it intergrades with. Fires would be less frequent than in the mixed conifer zone, with intervals of 25-50 years more common, and with smaller fire extents. This is supported by the prevalence of large diameter white fir trees in the overstory of these types.

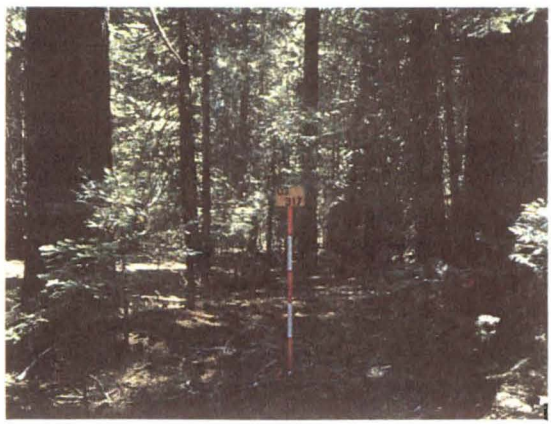
Productivity and Management:

Timber productivity is moderate to high, with high stocking and moderate to high site class. Silvicultural options are generally open. Natural regeneration is typically high, dominated by white fir.

The dense canopy overstories provide thermal cover. This group can provide high quality, late-seral dependent wildlife habitat. However, sometimes multiple tree canopy layering is absent or suppressed by the dense overstory layer. Forage is low.

ABCO-MCN/CARO1

Abies concolor-mixed conifer/Carex rossii
white fir-mixed conifer/Ross' sedge



Vegetation Summary Table
(Sample size: 11)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	57	100
PILA	sugar pine	15	100
CADE3	incense-cedar	20	91
PSME	Douglas-fir	29	73
PIPO	ponderosa pine	14	55
PIJE	Jeffrey pine	4	18
Tree Understory Layer			
ABCO	white fir	7	100
CADE3	incense-cedar	2	82
PILA	sugar pine	1	82
PSME	Douglas-fir	2	73
Shrubs			
SYMO	cr. snowberry	2	64
Herbs/Grasses			
CARO1	Ross' sedge	3	100
FERU	red fescue	2	45
KEGA	kelloggia	1	45
VILO	pine violet	1	45
HIAL	white-flwrd. hawkweed	1	45

Environment

Elev: 4900 (3500-5500)

Aspect: E, SE (NW)

Slope: 16% (2-47%)

Landfm: bottoms, mid- to lower slopes.

PASI: 240 (166-287)

Site Class: 1 (1A-2)

FSSC 3 (2-3)

Landscape Ecology and Environment:

This type appears to be associated mostly with the volcanic substrates of the southern Cascades, occurring less commonly at higher elevations in the Sierra Nevada mountains. The MCN/CARO1 association indicates moderate sites, with heavy snowpack, at higher elevations within the mixed conifer zone. Sites are gently sloping, toeslopes, lower slopes, or plains with east trending aspects. Soils are moderately deep, with moderate to high coarse fragments, developed from volcanic (or occasionally granititic) substrates. It occupies large areas in the landscape. Sites are often transitional to white fir types.

Vegetation:

Late seral forests are characterized by a dense conifer overstory and a sparse understory layer with Ross's sedge and often creeping snowberry. White fir dominates a multi-layered overstory. Sugar pine, Douglas-fir, and occasionally ponderosa or Jeffrey pine are typical minor components or rarely overstory co-dominants. Incense cedar is a minor component. White fir dominates the generally well developed regeneration with incense cedar, sugar pine, and Douglas-fir frequently present in low amounts. The prevalence of white fir in the overstory and understory indicates greater snowpack than is found in much of the mixed conifer zone.

The sparse understory is usually low in cover and species diversity. Ross's sedge is consistently present. Creeping snowberry, kelloggia, pine violet, and red fescue are also common, indicating moderate sites.

Fire Ecology:

The dominance of white fir in the large diameter classes and low topographic position, along with easterly aspects, suggest a natural fire regime of medium frequency, light or medium intensity fires that do not spread far. This is supported by the observations of fire scars on only half of the plots sampled, and then on only one or a few trees. Some evidence of fire, either as scars, charred bark, charred snags or logs, or soil charcoal were observed in all but one plot.

Productivity and Management:

Timber productivity is generally moderate to high, with moderate or high site class and high stocking. Silvicultural options are open. Advance regeneration is generally good. Competition from greenleaf manzanita or whitethorn may be a problem, especially following intense broadcast burning. Ross' sedge may be a slight competition problem. Suitable species for reforestation include ponderosa pine, sugar pine, and Douglas-fir at lower elevations. Natural regeneration of white fir and incense cedar is generally good. The moderately dense to dense canopies with one or few layers provides moderately suitable spotted owl, pine marten, and fisher habitat. When shrubby openings occur there is suitable summer deer range. Woodpeckers are likely to occur. The sensitive plant, Quincy lupine, may occur.

ABCO-MCN/SYMO/KEGA

Abies concolor-Mixed conifer/Symphoricarpos mollis/Kelloggia galioides
white fir-mixed conifer/creeping snowberry/kelloggia

Vegetation Summary Table
(Sample size: 17)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	66	100
CADE3	incense-cedar	30	94
PILA	sugar pine	23	82
PIPO	ponderosa pine	17	47
PIJE	Jeffrey pine	24	35
Tree Understory Layer			
ABCO	white fir	5	94
CADE3	incense-cedar	4	88
PILA	sugar pine	1	47
QUKE	black oak	1	41
Shrubs			
SYMO	cr. snowberry	1	71
Herbs/Grasses			
KEGA	kelloggia	1	76
HIAL	white-flwrd. hawkweed	1	41

Environment

Elev: 5300 (3800-6300)

Aspect: variable

Slope: 24% (8-51%)

Landfm: upper to mid-slopes

PASI: 247 (166-305)

Site Class: 2 (1-2)

FSSC 3 (2-3)

Landscape Ecology and Environment:

The ABCO-MCN/SYMO/KEGA association occurs at high elevations in the mixed conifer zone, intergrading with closely related white fir types. It occurs on gentle, upper to midslopes of varied aspect. Solar insolation is high. Soils are moderately deep to deep, formed on granitic or volcanic substrates. A.W.C.'s are typically moderate to high. It occupies variable, but often large areas in the landscape. It is closely related and often bounded by white fir types on the higher elevation sites.

Vegetation:

Late seral forests have a dense conifer overstory dominated by white fir, and scattered creeping snowberry or serviceberry in a usually sparse understory. White fir typically dominates all conifer layers, including regeneration, indicating high elevations and heavy snowpack for the mixed conifer zone. Sugar pine and incense-cedar are consistent minor associates. Ponderosa pine or Jeffrey pine often occur in varying amounts, increasing where there has been past fire disturbance. Douglas-fir and black oak are occasional associates.

A sparse understory develops under the dense overstory tree canopy, with small amounts of creeping snowberry the only consistent component. Other moderate site indicators, kelloggia and white-flowered hawkweed are present sporadically in low amounts.

Fire Ecology:

The varied aspects but consistent topographic position on upper or midslopes at high elevations suggests a natural fire regime similar to that for upper slopes in the white fir zone. This would likely be a regime of medium frequency, low to medium intensity fires spreading with small areas. Most of the plots had trees with catface fire scars or charred bark, but with only a few trees affected on each site. The relative proportions of fire resistant pines and susceptible white fir support the suggested regime, with pine occurring in most plots in varying amounts, but usually as a minor component. Fuel loading may build up quickly to very high levels due to the high stocking and dense fuel ladders may occur.

Productivity and Management:

Productivity is high, with moderate to high site class and high stocking. Silvicultural options are usually open, although sites on south or west-facing slopes may need shelterwoood for successful artificial regeneration; these sites have high solar insolation and soils can dry quickly. The very high stocking on these sites may lead to dense, suppressed understories; management may be necessary to meet objectives of multi-layered stands. Suitable reforestation species include white fir, ponderosa pine, sugar pine, and Jeffrey pine at higher elevations. Multi-layered stands provide suitable habitat for fisher, pine marten, and spotted owl foraging.

APPENDIX I

Species List

Common and Indicator Plants in the Westside Mixed Conifer Ecosystem

TREES - Conifers

Abies concolor	white fir	ABCO
Abies magnifica	red fir	ABMA
Calocedrus decurrens	incense cedar	CADE3
Pinus jeffreyi	Jeffrey pine	PIJE
Pinus lambertiana	sugar pine	PILA
Pinus ponderosa	ponderosa pine	PIPO
Pseudotsuga menziesii	Douglas-fir	PSME

TREES - Hardwoods

Acer macrophyllum	bigleaf maple	ACMA
Arbutus menziesii	Pacific madrone	ARME3
Cornus nuttallii	mountain dogwood	CONU2
Cornus sericea ssp. *sericea*	American dogwood	COSES*
Lithocarpus densiflorus	tanoak	LIDE2
Populus tremuloides	quaking aspen	POTR3
Populus trichocarpa	black cottonwood	POTR4
Quercus chrysolepis	canyon live oak	QUCH2
Quercus kelloggii	black oak	QUKE
Quercus wislizenii	interior live oak	QUWI
Rhamnus purshiana	cascara	RHPU

SHRUBS

Acer circinatum	vine maple	ACCI
Amelanchier utahensis	serviceberry	AMUT
Arctostaphylos nevadensis	pinemat manzanita	ARNE2
Chrysolepis sempervirens	bush chinquapin	CHSE2
Chamaebatia foliolosa	bear clover	CHFO2
Corylus cornuta var. *californica*	hazelnut	COCOC
Garrya fremontii	Fremont silk-tassel	GAFR
Gualtheria ovatifolia	Oregon spicy wintergreen	GAOV
Leucothoe davisiae	Sierra laurel	LEDA
Lithocarpus densiflorus var. *echinoides*	shrub tanoak	LIDEE
Quercus chrysolepis var. *nana*	(shrubby) canyon live oak	QUCHN
Quercus vaccinifolia	huckleberry oak	QUVA
Rhamnus californica	California coffeeberry	RHCA2
Rhamnus rubra	Sierra coffeeberry	RHRU
Rhododendron occidentale	western azalea	RHOC
Toxicodendron diversilobum	poison-oak	TODI
Rosa gymnocarpa	wood rose	ROGY
Rosa woodsii var. *ultramontana*	mountain rose	ROWOU
Rubus parviflorus	thimbleberry	RUPA2
Symphoricarpos mollis	creeping snowberry	SYMO
Vaccinium parvifolium	red huckleberry	VAPA

FORBS

Adenocaulon bicolor	trail plant	ADBI
Achillea millefolium	yarrow	ACMI
Allium species	onion	ALL2
Allium campanulatum	Sierra onion	ALCA2
Antennaria rosea	rosy everlasting	ANRO
Apocynum species	dogbane	APO
Aquilegia formosa	crimson columbine	AQFO
Arabis constancei	Constance's rock cress	ARCO7
Asarum hartwegii	Hartweg's wild-ginger	ASHA
Calochortus clavatus var. *avius*	Pleasant Vly Mariposa lily	CACLA1
Calochortus coerulus	beavertail-grass	CACO4
Calyptridium umbellatum	pussypaws	CAUM2
Campanula prenanthoides	California harebell	CAPR6
Castelleja applegatei	wavy-lvd Indian paintbrush	CAAP
Chimaphila menziesii	little prince's pine	CHME2
Chimaphila umbellata	western prince's pine	CHUM*
Chlorogalum pomeridianum	soap plant	CHPO1
Clintonia uniflora	queen's cup	CLUN2
Disporum hookeri	fairy bells	DIHO2
Eriogonum nudum	naked-stemmed eriogonum	ERNU3
Eriophyllum lanatum	common woolly sunflower	ERLA6
Fragaria vesca	wood strawberry	FRVE2

FORBS

Galium aparine	cleavers	GAAP
Galium bolanderi	Bolander's bedstraw	GABO1
Galium triflorum	fragrant bedstraw	GATR2
Heuchera micrantha	small-flowered heuchera	HEMI4
Hieracium albiflorum	white-flowered hawkweed	HIAL
Iris hartwegii	Hartweg's iris	IRHA
Iris species	iris species	IRI
Iris tenuissima	slender iris	IRTE
Kelloggia galioides	kelloggia	KEGA
Lathyrus nevadensis	Sierra Nevada pea	LANE2
Ligusticum grayi	Gray's lovage	LIGR1
Lithophragma heterophyllum	woodland star	LIHE
Lupinus dalesiae	Quincy lupine	LUDA
Lupinus polyphyllus	large-leaved lupine	LUPO
Navarretia prolifera ssp. *lutea*	yellow bur navarretia	NAPRL
Orthilia secunda	one-sided wintergreen	ORSE*
Osmorhiza chilensis	mountain sweet-cicely	OSCH
Pedicularis semibarbata	pine lousewart	PESE3
Penstemon personatus	close-throated beardtongue	PEPE4
Polygala cornuta	milkwort	POCO6
Pseudostellaria jamesiana	sticky starwort	PSJA*
Pyrola picta	white-veined wintergreen	PYPI
Sanicula graveolens	Sierra sanicle	SAGR1
Sanicula tracyi	Tracy's sanicle	SATR1
Senecio triangularis	arrow-leaved groundsel	SETR

FORBS

Silene lemmonii	Lemmon's campion	SILE
Smilacina racemosa	false Solomon's seal	SMRA
Stephanomeria lactucina	large-flwrd stephanomeria	STLA2
Thalictrum fendleri	Fendler's meadow rue	THFE
Trientalis latifolia	starflower	TRLA3
Trillium ovatum ssp. *oettingeri*	Salmon Mtn. wakerobin	TROVO1*
Viola lobata	pine violet	VILO
Viola purpurea	mountain violet	VIPU
Viola sheltonii	fan violet	VISH
Viola tomentosa	woolly violet	VITO
Whitneya dealbata	whitneya	WHDE

GRAMINOIDS

Achnatherum species	needlegrass	ACH4*
Achnatherum occidentalis	western stipa	ACOC*
Bromus inermis	smooth brome	BRIN1
Bromus orcuttianus	Orcutt's brome	BROR1
Carex geyeri	Geyer's sedge	CAGE
Carex multicaulis	multi-stemmed sedge	CAMU1
Carex rossii	Ross' sedge	CARO1
Elymus elymoides	squirreltail	ELEL*
Festuca occidentalis	western fescue	FEOC
Festuca rubra	red fescue	FERU
Melica aristata	awned melic	MEAR1

LOWER PLANTS

Pellea mucronata	birdsfoot fern	PEMU
Polystichum munitum	sword fern	POMU1
Pteridium aquilinum var. *pubescens*	bracken fern	PTAQP

Primarily Disturbance Indicators

Arctostaphylos patula	greenleaf manzanita	ARPA9
Arctostaphylos viscida	whiteleaf manzanita	ARVI3
Ceonothus cordulatus	mountain whitethorn	CECO
Ceonothus integerrimus	deerbrush	CEIN3
Ceanothus prostratus	squawcarpet	CEPR
Ribes roezlii	Sierra gooseberry	RIRO

*Not in ADP code book

APPENDIX II

Soil Summary Tables by Plant Association

Summary of soil characteristics by plant association.

TYPE	TOTAL DEPTH mode/range	PARENT MATERIAL	A HOR. COARSE FRAG. mean/range	A HOR. TEXTURE	SUBSOIL COARSE FRAG. mean/range	SUBSOIL TEXT.	AWC mean/range
ABCO-MCN/ACCI-CHSE2	41"+	volc	11(1-20)	l,cosl	39(15-65)	cosl,kscl	4.8"(3.4-5.7")
ABCO-MCN/ADBI	41"+	variable	25(3-75)	cosl,sl,l,vgl	30(2-75)	cosl,l,gcl	3.8"(1.1-7.0")
ABCO-MCN/CARO1	24-32"(41"+)	volc(gran)	21(2-40)	gsl,gl,sl	30(2-55)	gcl,gsl,vksl	3.6"(2.3-5.5")
ABCO-MCN/CHSE2	41"+(30-40")	volc,gran	21(2-40)	gsl,l,ksl	32(3-55)	gcsl,sl	3.8"(2.5-5.6")
ABCO-MCN/SMRA-DIHO2	21-38"(41"+)	variable	23(0-60)	gsl,sl,l	28(0-65)	gcl,sl,xgl	3.3"(1.2-5.8")
ABCO-MCN/SYMO-KEGA	41"+(21-38")	volc(gran)	21(4-50)	sl,l,vgl	34(5-70)	vgl,gsl,cosl	3.8"(2.4-6.1")
PIPO-MCN/ANRO-ERNU3	30-41"+	gran	9(1-30)	cosl,sl	12(8-25)	lcos,gls,ls	3.0"(1.9-4.6")
PIPO-MCN/ARC-CHFO2	<20"	(Ledmont soils)		DATA NOT AVAILABLE			
PIPO-MCN/CHFO2/GABO1	41"+	volc,metm	17(0-60)	l	17(0-60)	cl,sicl,gcl	4.9"(1.2-6.5")
PIPO-MCN/GABO1-POCO6	41"+(25-38")	volc(var)	23(3-70)	l,gl,gsl,sl	33(0-80)	sicl,vgcl,vkl	4.1"(1.4-7.4")
PIPO-MCN-LIDE2/CHFO2	32-41"+	metm	33(10-55)	gl,cl,l	33(0-50)	vscl,l,c	3.3"(1.3-6.0")
PIPO-MCN-QUCH2/CHFO2	30-41"+	gran,volc	22(3-60)	sl,cosl	37(12-65)	vgl,cosl,sl	3.4"(1.5-4.7")
PIPO-MCN-QUCH2/GABO1	30-41"+	variable	18(0-40)	sl,gsl,cl	21(5-58)	sl,gscl,cl	4.1"(2.1-6.4")
PIPO-MCN/QUCHN-QUVA	0-41"+	granitic outcrop with pockets of soil			DATA NOT AVAILABLE		
PIPO-MCN/QUVA (serp)	41"+(13-27)	serpentine	29(10-68)	l,xstl	36(5-60)	cl,stcl	3.5"(1.0-5.8")

Summary of soil characteristics by plant association.

TYPE	TOTAL DEPTH mode/range	PARENT MATERIAL	A HOR. COARSE FRAG. mean/range	A HOR. TEXTURE	SUBSOIL COARSE FRAG. mean/range	SUBSOIL TEXT.	AWC mean/range
PSME-MCN-ACMA/ADBI	20-40",41"+	variable	27(1-95)	gl,vgl,gsl	36(3-90)	gscl,cl,stsl	3.8"(0.5-6.0")
PSME-MCN/AMUT	12-20"	metm	43(18-65)	xgl,gsil,sicl	42(5-65)	sicl,vgcl,cosl	1.4"(0.7-3.0")
PSME-MCN/COCOC	41"+(20-35")	variable	22(0-80)	l,sl,gl	23(1-80)	cl,gl,sil	4.7"(0.7-6.5")
PSME-MCN-CONU2/ADBI	41"+	variable	23(0-65)	l,gsl,cosl	26(0-65)	cosl,gcl,l	4.6"(1.9-7.5")
PSME-MCN-CONU2/COCOC	41"+	volc(var)	16(1-48)	sl,gsl,gl	13(4-40)	cl,sl	5.5"(3.8-6.5")
PSME-MCN-LIDE2/COCOC	41"+(20-30")	gran,metm	16(0-45)	sl,gl,lcos	18(4-30)	gc,lcos,cl	4.1"(2.0-5.9")
PSME-MCN-LIDE2-CONU2	41"+(22-33")	metm,gran	26(5-60)	gl,sl,lcos	22(5-70)	sicl,lcos	4.2"(2.0-7.7")
PSME-MCN-LIDE2/IRI	41"+(17-36")	metm,gran	11(0-30)	l,sl,gl	17(0-55)	cl,gl,sicl	4.6"(0.7-8.7")
PSME-MCN-QUCH2/POMU1	41"+(16-28)	metm,gran	17(1-25)	sl,lcos	25(5-37)	sl,lcos	2.6"(0.8-5.2")
PSME-MCN/QUVA	17-34"	schist	46(3-55)	vgl	60(45-80)	vgl,vscl	1.7"(1.1-2.3")
PSME-MCN/TRLA3	41"+(38)	volc(var)	29(0-60)	gs,l,sl,vgl	33(5-80)	gscl,stsl	4.4"(3.0-6.4")

APPENDIX III

Forest Structure Tables by Plant Association (Productivity/Snags/Logs/Vegetation)

Trees per acre, total basal area, stand density index, standing cubic volume, softwood growth, Dunning's site class and site index averaged by type.

TYPE	FOREST SURVEY DUNNING'S SITE CLASS mode/range		STAND DENSITY INDEX mean/S.D.(range)	TOTAL BASAL AREA mean/S.D.(range)	STANDING CUBIC VOLUME mean/S.D.(range)
ABCO-MCN/ACCI-CHSE2	1(1-2)	2(2-3)	635/186	373/89 (267-453)	112.0/ (81.5-129.5)
ABCO-MCN/ADBI	1A(1A-2)	2(1-3)	601/108	373/84 (320-506)	157.3/44 (100.1-236.3)
ABCO-MCN/CARO1	1(1A-2)	3(2-3)	625/156	405/81 (293-560)	143.9/44 (103.2-175.0)
ABCO-MCN/CHSE2	2(1-3)	3(2-4)	550/183	368/129(220-640)	136.4/56 (82.0-241.0)
ABCO-MCN/SMRA-DIHO2	1(1A-2)	2(1-4)	606/97	370/74 (267-460)	145.8/39 (85.5-205.7)
ABCO-MCN/SYMO/KEGA	2(1-2)	3(2-3)	714/156	437/86 (320-587)	143.9/36 (88.9-199.2)
PIPO-MCN/ANRO-ERNU3	1(1-2)	3(3-4)	428/110	274/27 (240-320)	101.3/18 (79.3-130.4)
PIPO-MCN/ARC-CHFO2			DATA NOT AVAILABLE		
PIPO-MCN/CHFO2/GABO1	2(1A-3)	3(2-4)	433	273/107(240-480)	169.1/71 (82.3-201.5)
PIPO-MCN/GABO1-POCO6	2(1A-2)	3(2-4)	655/206	391/105(186-560)	131.1/44 (47.8-186.2)
PIPO-MCN-LIDE2/CHFO2	2(1-3)	3(3-4)	390/41	274/87 (170-380)	100.5/22 (87.3-125.8)
PIPO-MCN-QUCH2/CHFO2	1(1-3)	2(2-3)	477/163	283/57 (254-360)	99.6/ (67.3-152.9)
PIPO-MCN-QUCH2/GABO1	2(1-2)	3(2-4)	438/182	253/76 (147-387)	93.6/37 (38.0-169.2)
PIPO-MCN/QUCHN-QUVA	4			153	28.1
PIPO-MCN/QUVA serp	2(2-3)	4(3-4)	290/119	225/129(73-440)	64.3/51 (13.1-146.5)

Trees per acre, total basal area, stand density index, standing cubic volume, softwood growth, Dunning's site class and site index averaged by type—continued.

TYPE	FOREST DUNNING'S SITE CLASS mode/range	SURVEY	STAND DENSITY INDEX mean/S.D.(range)	TOTAL BASAL AREA mean/S.D.(range)	STANDING CUBIC VOLUME mean/S.D.(range)
PSME-MCN-ACMA/ADBI	1(1A-1)	2(1-3)	522/128	323/72 (213-440)	120.5/35 (86.2-182.4)
PSME-MCN/AMUT	3(1-4)	5(2-5)	435/170	306/121(100-440)	89.9/39 (42.1-159.91)
PSME-MCN/COCOC	1A(1A-1)	2(1-2)	531/89	375/54 (320-493)	145.1/36 (92.8-198.0)
PSME-MCN-CONU2/ADBI	1A(1A-1)	2(1-3)	582/168	365/113(180-653)	135.4/52 (52.4-253.9)
PSME-MCN-CONU2/COCOC	1A(1A-1)	1(1-2)	526/183	329/101(290-520)	145.4/47 (73.5-232.8)
PSME-MCN-LIDE2/COCOC	1A(1A-1)	2(1-2)	531/122	338/95 (150-480)	138.2/26 (88.8-184.1)
PSME-MCN-LIDE2-CONU2	1A(1A-1)	2(1-2)	537/124	367/96 (280-520)	128.4/39 (85.0-189.8)
PSME-MCN-LIDE2/IRI	1(1A-2)	3(1-3)	551/228	315/126(140-453)	144.4/83 (80.5-345.7)
PSME-MCN-QUCH2/POMU1	2(1-2)	3(3-4)	482/162	285/81 (207-373)	89.5/ (80.2-95.2)
PSME-MCN/QUVA	2(2-4)	4(3-5)	444/127	278/61 (153-373)	84.5/27 (44.7-126.8)
PSME-MCN/TRLA3	2(1A-2)	3(2-4)	563/211	349/111(227-640)	138.9/52 (90.0-267.9)

Canopy cover by layer/life form.

TYPE	TOTAL VEGETATION COVER (%)	TOTAL TREE COVER (%)	TOTAL SHRUB COVER (%)	TOTAL HERB COVER (%)	TOTAL GRAMINOID COVER (%)
ABCO-MCN/ACCI-CHSE2	99(97-100)	94(85-99)	38(20-95)	4(2-10)	1(0-1)
ABCO-MCN/ADBI	94(54-100)	91(51-99)	5(0-18)	15(2-88)	2(0-11)
ABCO-MCN/CARO1	93(80-98)	94(88-98)	4(1-11)	2(1-5)	4(1-15)
ABCO-MCN/CHSE2	93(70-99)	88(70-98)	31(3-77)	6(1-15)	3(0-10)
ABCO-MCN/SMRA-DIHO2	92(75-99)	91(75-98)	3(1-10)	2(1-4)	1(0-4)
ABCO-MCN/SYMO/KEGA	96(90-99)	95(88-98)	2(0-3)	2(1-7)	1(0-3)
PIPO-MCN/ANRO-ERNU3	92(85-97)	84(74-93)	10(1-45)	1(1-3)	3(1-6)
PIPO-MCN/ARC-CHFO2		30	60	15	5
PIPO-MCN/CHFO2/GABO1	94(75-99)	78(50-95)	58(8-96)	6(1-45)	3(1-5)
PIPO-MCN/GABO1-POCO6	91(50-99)	87(47-97)	8(0-70)	5(1-18)	3(0-15)
PIPO-MCN-LIDE2/CHFO2	94(90-96)	79(65-94)	53(25-80)	8(1-15)	2(0-7)
PIPO-MCN-QUCH2/CHFO2	85(50-98)	73(45-94)	29(1-60)	7(1-36)	2(0-5)
PIPO-MCN-QUCH2/GABO1	90(65-99)	83(65-97)	12(1-44)	14(1-55)	6(1-12)
PIPO-MCN/QUCHN-QUVA	30	25	20	5	1
PIPO-MCN/QUVA serp	92(80-97)	55(30-85)	73(42-94)	10(3-42)	6(1-30)

Canopy cover by layer/life form.

TYPE	TOTAL VEGETATION COVER (%)	TOTAL TREE COVER (%)	TOTAL SHRUB COVER (%)	TOTAL HERB COVER (%)	TOTAL GRAMINOID COVER (%)
PSME-MCN-ACMA/ADBI	98(94-100)	95(80-100)	23(1-82)	25(3-88)	7(0-48)
PSME-MCN/AMUT	91(75-99)	83(62-98)	10(1-30)	12(1-36)	9(1-35)
PSME-MCN/COCOC	95(85-99)	89(80-97)	11(1-35)	31(2-95)	3(1-9)
PSME-MCN-CONU2/ADBI	98(96-99)	95(86-99)	8(0-34)	21(2-65)	2(0-14)
PSME-MCN-CONU2/COCOC	99(97-100)	94(80-99)	20(3-87)	33(4-68)	2(0-12)
PSME-MCN-LIDE2/COCOC	96(80-100)	89(70-98)	12(3-29)	23(2-63)	1(0-5)
PSME-MCN-LIDE2-CONU2	98(94-100)	96(93-99)	6(0-19)	23(4-61)	1(0-6)
PSME-MCN-LIDE2/IRI	92(75-99)	88(60-98)	10(0-41)	6(1-18)	2(0-18)
PSME-MCN-QUCH2/POMU1	87(70-98)	76(65-85)	2(1-3)	6(3-10)	3(1-5)
PSME-MCN/QUVA	94(86-99)	87(80-97)	31(3-85)	14(2-61)	7(1-21)
PSME-MCN/TRLA3	92(80-99)	89(70-98)	3(0-10)	10(1-26)	2(0-7)

APPENDIX IV

Fire Evidence Table by Plant Association

Visible fire evidence (cat-face scars, charred bark, burned snags, charred logs, and charcoal in the soil) by plant association. Values represent number of plots with attribute.

	LIVE TREES										DEAD & DOWN TREES										SOIL				
	cat-face scars					charred bark					burned snags					charred logs or charcoal					charcoal				
	0	1	F	M	A*	0	1	F	M	A	0	1	F	M	A	0	1	F	M	A	0	1	F	M	A
ABCO-MCN/ACCI-CHSE2	2	0	2	0	0	3	1	0	0	0	4	0	0	0	0	2	2	0	0	0	2	2	0	0	0
ABCO-MCN/ADBI	8	5	6	0	0	12	4	3	0	0	15	4	0	0	0	14	1	4	0	0	19	0	0	0	0
ABCO-MCN/CARO1	5	2	3	1	0	8	0	3	0	0	8	2	1	0	0	7	0	4	0	0	9	1	0	0	0
ABCO-MCN/CHSE2	4	0	2	2	0	5	0	2	1	0	7	0	1	0	0	3	4	0	1	0	8	0	0	0	0
ABCO-MCN/SMRA-DIHO2	3	0	6	2	0	9	1	1	0	0	10	1	0	0	0	8	2	1	0	0	10	1	0	0	0
ABCO-MCN/SYMO-KEGA	3	1	6	0	0	8	0	2	0	0	7	2	1	0	0	9	1	0	0	0	10	0	0	0	0
PIPO-MCN/ANRO-ERNU3	0	6	0	0	0	4	1	0	1	0	6	0	0	0	0	1	2	3	0	0	6	0	0	0	0
PIPO-MCN/ARC-CHFO2	0	0	0	2	0	0	1	1	0	0	2	0	0	0	0	2	0	0	0	0	2	0	0	0	0
PIPO-MCN/CHFO2/GABO1	1	2	1	1	0	3	1	1	0	0	5	0	0	0	0	4	1	0	0	0	5	0	0	0	0
PIPO-MCN/GABO1-POCO6	8	3	12	6	0	19	0	6	2	0	26	1	1	0	0	20	6	3	0	0	26	1	1	0	0
PIPO-MCN-LIDE2/CHFO2	2	0	1	0	0	1	1	0	1	0	3	0	0	0	0	2	0	1	0	0	3	0	0	0	0
PIPO-MCN-QUCH2/CHFO2	1	1	1	0	0	2	1	0	0	0	2	1	0	0	0	1	2	0	0	0	3	0	0	0	0
PIPO-MCN-QUCH2/GABO1	3	1	3	0	0	4	0	2	0	0	5	0	0	0	0	5	0	0	0	0	4	1	0	0	0
PIPO-MCN/QUCHN-QUVA	no data available																								
PIPO-MCN/QUVA serp	5	2	1	0	0	4	0	4	0	0	5	2	1	0	0	6	2	0	0	0	7	0	1	0	0

Visible fire evidence (catface scars, charred bark, burned snags, charred logs, and charcoal in the soil) by plant association.
Values represent number of plots with attribute.
—continued—

	LIVE TREES										DEAD & DOWN TREES										SOIL				
	cat-face scars					charred bark					burned snags					charred logs or charcoal					charcoal				
	0	1	F	M	A*	0	1	F	M	A	0	1	F	M	A	0	1	F	M	A	0	1	F	M	A
PSME-MCN-ACMA/ADBI	7	0	1	2	0	4	0	4	2	0	10	0	0	0	0	3	6	0	0	0	9	1	0	0	0
PSME-MCN/AMUT	2	1	3	1	0	5	0	1	1	0	6	0	1	0	0	5	0	1	1	0	6	1	0	0	0
PSME-MCN/COCOC	6	1	1	0	0	5	1	1	1	0	7	0	1	0	0	6	2	0	0	0	5	3	0	0	0
PSME-MCN-CONU2/ADBI	16	3	3	0	0	16	1	5	0	0	20	2	0	0	0	15	6	1	0	0	18	4	0	0	0
PSME-MCN-CONU2/COCOC	4	2	1	0	0	5	2	0	0	0	5	2	0	0	0	6	1	0	0	0	6	1	0	0	0
PSME-MCN-LIDE2/COCOC	4	0	1	0	0	4	1	0	0	0	5	0	0	0	0	4	1	0	0	0	5	0	0	0	0
PSME-MCN-LIDE2-CONU2	10	4	0	0	0	17	2	2	0	0	17	4	0	0	0	14	5	2	0	0	17	3	1	0	0
PSME-MCN-LIDE2/IRI	8	1	1	3	0	8	2	3	1	0	10	1	0	0	0	9	4	1	0	0	14	0	0	0	0
PSME-MCN-QUCH2/POMU1	2	1	1	0	0	4	0	0	0	0	4	0	0	0	0	2	1	1	0	0	4	0	0	0	0
PSME-MCN/QUVA	no data available																								
PSME-MCN/TRLA3	2	1	3	6	0	9	2	0	1	0	11	1	0	0	0	2	6	3	1	0	11	1	0	0	0

* 0 =no evidence, 1 =one tree or snag,log, F =few, M =many, A =all

APPENDIX V

Environmental Summary

Summary of environmental characteristics by plant association.

TYPE	ELEVATION mean/range	ASPECT	SLOPE mean/range	TOPOGRAPHIC POSITION	PASI mean/range	SITE CLASS mean/range
ABCO-MCN/ACCI-CHSE2	4700 (4600-4800)	N,NE,NW	49% (32-68%)	lower slopes	203 (168-267)	1 (1-2)
ABCO-MCN/ADBI	4700 (2800-6100)	N,NE,NW	26% (4-60%)	lower slopes to bottoms	229 (138-291)	1A (1A-2)
ABCO-MCN/CARO1	4900 (3500-5500)	E,SE	16% (2-47%)	bottoms to mid-slopes	240 (166-287)	1 (1A-2)
ABCO-MCN/CHSE2	5500 (4800-6200)	Variable	31% (10-59%)	mid-slopes	253 (179-297)	2 (1-3)
ABCO-MCN/SMRA-DIHO2	5000 (4100-5600)	NE,E,NW	35% (5-55%)	upper to mid-slopes	226 (180-253)	1 (1A-2)
ABCO-MCN/SYMO-KEGA	5300 (3800-6300)	Variable	24% (8-51%)	upper to mid-slopes	247 (166-305)	2 (1-2)
PIPO-MCN/ANRO-ERNU3	5100 (4900-5300)	Variable	48% (38-60%)	mid-slopes	224 (137-294)	1 (1-2)
PIPO-MCN/ARC-CHFO2	4700 (3400-5600)	S,SW	21% (2-40%)	ridges to upper slopes	DATA NOT AVAILABLE	
PIPO-MCN/CHFO2/GABO1	4300 (3300-5700)	SW,SE	17% (3-43%)	ridges to upper slopes	267 (229-301)	2 (1A-3)
PIPO-MCN/GABO1-POCO6	4600 (2200-5900)	SW,SE,E	37% (1-65%)	ridges to mid-slopes	262 (162-311)	2 (1A-2)
PIPO-MCN-LIDE2/CHFO2	4200 (2900-5600)	S,SW	35% (0-55%)	upper slopes	282 (248-306)	2 (1-3)
PIPO-MCN-QUCH2/CHFO2	4300 (3000-4900)	S,SW,E	52% (27-86%)	upper to mid-slopes	282 (206-216)	2 (2-3)
PIPO-MCN-QUCH2/GABO1	3100 (2500-4400)	SW,S,E	44% (25-62%)	upper to lower slopes	254 (149-315)	2 (1-2)
PIPO-MCN/QUCHN-QUVA	5400	W,S,SW	23% (8-35%)	lower slopes	DATA NOT AVAILABLE	
PIPO-MCN/QUVA (serp)	4900 (3500-5800)	NW,E,SE	26% (10-70%)	mid- to upper slopes	247 (219-276)	2 (2-3)

Summary of environmental characteristics by plant association.

TYPE	ELEVATION mean/range	ASPECT	SLOPE mean/range	TOPOGRAPHIC POSITION	PASI mean/range	SITE CLASS mean/range
PSME-MCN-ACMA/ADBI	4200 (3500-5300)	N,NE	53% (14-75%)	lower slopes	189 (117-295)	1A (1A-1)
PSME-MCN/AMUT	4400 (3500-5200)	SE,NW	37% (5-70%)	ridges to mid-slopes	234 (165-300)	3 (1-4)
PSME-MCN/COCOC	3800 (2100-4800)	N,NE,NW	38% (12-80%)	mid- to lower slopes	227 (125-311)	1A (1A-1)
PSME-MCN-CONU2/ADBI	4300 (3200-5500)	N,NE,NW	28% (3-50%)	lower to mid-slopes	222 (161-277)	1A (1A-1)
PSME-MCN-CONU2/COCOC	4000 (3300-4800)	N,NE	38% (3-66%)	lower to mid-slopes	192 (143-274)	1A (1A-1)
PSME-MCN-LIDE2/COCOC	3400 (2200-4700)	W,N,E	43% (12-69%)	drainages, lwr/mid-slopes	237 (170-311)	1A (1A-1)
PSME-MCN-LIDE2-CONU2	3800 (3200-4500)	E,NE,SE	28% (5-48%)	mid- to lower slopes	246 (183-289)	1A (1A-1)
PSME-MCN-LIDE2/IRI	4200 (2600-5400)	SW,S,SE	31% (5-59%)	mid- to upper slopes	255 (177-299)	1 (1A-2)
PSME-MCN-QUCH2/POMU1	3800 (3000-4400)	E,SE,S	55% (35-75%)	lower to mid-slopes	266 (192-312)	2 (1-2)
PSME-MCN/QUVA	4900 (4500-5300)	NW,E	56% (45-64%)	upper slopes	206 (154-274)	2 (2-4)
PSME-MCN/TRLA3	4600 (4200-5200)	S,SW,E	35% (5-55%)	upper slopes to ridges	242 (145-297)	3 (2-4)

APPENDIX VI

Ecoclass Codes

Ecoclass Codes

Mixed Conifer Series Group

- Douglas-fir -mixed conifer- big-leaf maple/trail plant . . . CXHB12
- Mountain Dogwood Group . . . . . CXHD
  - Douglas-fir -mixed conifer- mountain dogwood/hazelnut . . CXHD12
  - Douglas-fir -mixed conifer- mountain dogwood/trail plant . CXHD13
- Tanoak Group . . . . . CXHT
  - Douglas-fir -mixed conifer-tanoak/hazelnut CXHT11
  - Douglas-fir -mixed conifer-tanoak-mountain dogwood . . . CXHT12
  - Douglas-fir -mixed conifer-tanoak/bearclover CXHT13
  - Douglas-fir -mixed conifer-tanoak/iris CXHT14
- Bearclover Group CXS06
  - Ponderosa pine-mixed conifer/manzanita-bearclover CXS0611
  - Ponderosa pine-mixed conifer/bearclover/ Bolander's bedstraw CXS0612
- Canyon Live Oak Group . . . . . CXHL
  - Ponderosa pine-mixed conifer-canyon live oak/bearclover . . CXHL11
  - Ponderosa pine-mixed conifer-canyon live oak/ Bolanders bedstraw CXHL13
  - Douglas-fir -mixed conifer-canyon live oak/sword fern . . . CXHL14
- Evergreen Shrub Group CXS05
  - White fir-mixed conifer/vine maple-bush chinquapin CXS0511
  - White fir-mixed conifer/bush chinquapin CXS0512
  - Ponderosa pine-mixed conifer/shrubby canyon live oak -huckleberry oak CXS0513
  - Ponderosa pine-mixed conifer/huckleberry oak (serpentine) . CXS0514
- Dry Group CXF03
  - Douglas-fir -mixed conifer/serviceberry CXF0311
  - Ponderosa pine-mixed conifer/Bolander's bedstraw-milkwort CXF0312
  - Ponderosa pine-mixed conifer/rosy everlasting -naked-stemmed buckwheat CXF0313
- Moist Group CXF01
  - Douglas-fir -mixed conifer/hazelnut CXF0111
  - White fir-mixed conifer/trail plant CXF0112
  - White fir-mixed conifer/false Solomon's seal- Hooker's fairy bells CXF01113
  - Douglas-fir -mixed conifer/starflower CXF0213
- Moderate Group CXF02
  - White fir-mixed conifer/Ross' sedge CXF0211
  - White fir-mixed conifer/creeping snowberry/kelloggia . . . CXF0212

Riparian Group

- Douglas-fir -mixed conifer/American dogwood CXS0711
- Douglas-fir -mixed conifer/Sierra laurel CXS0712
- White fir-mixed conifer/mountain alder/sedge CXS0715
- White fir-mixed conifer/mountain alder/monkshood CXS0716
- Douglas-fir -mixed conifer-white alder/Indian rhubarb . . . CXHA11

APPENDIX VII

Glossary

Glossary

A.W.C.—Available water holding capacity. Calculated for the full depth of soils (up to 41").

Canopy Cover—The area of ground included in a vertical projection of individual plant canopies.

Constancy—The percentage of plots within a type that contain the species. A constancy of 75% means that the species was present in 75% of the plots used to describe the type.

CONS—Abbreviation for constancy.

Cover—See canopy cover above.

Depauperate—A stand with sparse ground covering vegetation due to (1) tree overstory density precluding sufficient light for understory plant growth, or (2) a deep restricted litter or duff layer, or (3) a combination of limiting site factors.

Dominant—A plant or group of plants which by their collective size, mass, or number exert the most influence on other components of the ecosystem. Use also to describe species with the greatest canopy cover on a site.

Ecological Type—A category of land having a unique combination of potential natural community, soil, landscape features, climate, and differing from other ecological types in its ability to produce vegetation and respond to management. Categories of ecological types include all sites that have this unique combination of components with the defined ranges of properties. (FSM 2060).

Ecotone—A zone between adjacent areas of contrasting potential natural vegetations where there is a gradual change in type (a fuzzy vs. an abrupt boundary).

Forb—An herbaceous plant other than a sedge, grass, rush or other graminoid plant.

FSSC—Forest survey site class.

Graminoid—A grass or grass-like plant.

Indicator Species—A species that is sensitive to important environmental features of a site such that its constancy or abundance reflects significant changes in environmental factors.

Landfm—Abbreviation for landform.

PASI—Potential annual solar radiation index.

Plant Association—A potential natural plant community of definite floristic composition and uniform appearance. (FSM 2060)

Potential Natural Plant Community—The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances, such as drought, floods, wildfire, insects, and disease, are inherent in the development of potential natural communities which may include naturalized nonnative species. (FSM 2060.5). PNPC's have also been called plant associations, habitat types, and range sites.

Seral (or Successional) Stage—A stage of development of a plant community that is distinguished by composition and structure from other stages in the successional process.

Series—An aggregation of taxonomically related associations that takes the names of the (climatic) climax species that dominate or have the potential to dominate the principal layers, in a time frame appropriate to the vegetative or taxonomic group under consideration.

Site Class—Dunning's site class (Dunning 1928).

Stand—Vegetation occupying a specific area and sufficiently uniform in species composition, age arrangement, structure, and conditions to be distinguished from the vegetation on adjoining areas.

Succession—Changes in species composition and vegetation structure over time, following disturbance (secondary succession) or with soil development or colonization on unvegetated rocks (primary succession).

KEY ECOLOGICAL MAPPING CONCEPTS

Existing Vegetation Mapping Layer—Relatively homogeneous areas in the landscape with respect to plant species composition, seral stage (or stand development stage) and size.

Potential Natural Vegetation Mapping Layer—An area in the landscape with the potential for developing into a plant association (or group of related plant associations), with the absence of disturbance. Associated with complex combination of soil and climatic factors.

Ecological Map Unit—The map unit developed for an ecological type or types. A riparian ecological unit is a map unit developed for a riparian ecological type or types. This unit may include a complex of small and intricately associated ecological types too small to delineate separately.

APPENDIX VIII

Preliminary Plant Associations for Undersampled Types/Riparian Areas

PIPO-MCN-LIDE2/CHFO2

Pinus ponderosa-mixed conifer-Lithocarpus densiflorus/Chamaebatia foliolosa

ponderosa pine-mixed conifer-tanoak/bearclover

Vegetation Summary Table

(Sample size: 5)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	19	100
PIPO	ponderosa pine	42	80
PILA	sugar pine	25	60
LIDE2	tanoak	15	60
CADE3	incense cedar	8	60
ABCO3	white fir	7	60
ARME3	madrone	16	40
Tree Understory Layer			
LIDE2	tanoak	13	100
PSME	Douglas-fir	3	80
CADE3	incense cedar	10	60
PIPO	ponderosa pine	4	60
PILA	sugar pine	2	60
ABCO	white fir	3	40
Shrubs			
CHFO2	bearclover	33	100
LIDEE	shrub tanoak	14	60
Herbs/Grasses			
CHUM	w. prince's pine	3	60
POCO6	milkwort	2	60
GABO1	B. bedstraw	1	60
TRLA3	starflower	3	40

Environment

Elev: 4200 (2900-5600)

Aspect: S, SW

Slope: 35% (0-55%)

Landfm: upper slopes

PASI: 282 (248-306)

Site Class: 2 (1-3)

FSSC 3 (3-4)

Landscape Ecology and Environment:

This uncommon type occurs in transitional areas between PIPO-MCN/CHFO2/GABO1 and tanoak types. Although likely ecotonal, it is described because it occupies significant areas where it occurs and has unique management interpretations. This association occupies dry, south-facing, upper slopes in areas of higher local precipitation. Soils are moderately deep, formed on metamorphic (schist) substrates. Coarse fragments are high, especially in the subsoil horizons.

Vegetation:

Late seral stands are characterized by an open conifer overstory, tanoak in the mid-story or shrub layers, and bearclover in a low shrub layer. Ponderosa pine and often sugar pine dominate the overstory. Incense cedar and Douglas-fir comprise minor components in the overstory, but may dominate the understory conifers. Tanoak sometimes forms a mid-story, but is most consistently present in the shrub form and as regeneration.

A mixture of bearclover and shrub form tanoak dominate the well developed, often dense shrub layer. A mixture of dry site and moderately moist site indicator herbs are present in low amounts, further substantiating the transitional position of this type. Typical dry site species are Bolander's bedstraw and milkwort. Starflower also occurs, indicating more moderate to moist sites.

Fire Ecology:

The natural fire regime of this type is likely frequent, low intensity fires due to the dry, upper-slope topographic position. The flammability of bearclover resulted in fairly even spread of fires throughout sites occupied by this type. Frequent fires would result in maintenance of shrub form tanoak and suppression of growth of tree form tanoak.

Productivity and Management

Productivity is similar to the PIPO-MCN/CHFO2/GABO1 type, with moderately high site class but low stocking due to the dense bearclover. Stocking may be higher than in the PIPO-MCN/CHFO2/GABO1 type due to the higher precipitation indicated by tanoak and the ecotonal position of this type. Some sites, especially on the Foresthill Ranger District of the Tahoe National Forest, may occur on Hurlbut soils. These sites have greater management limitations and should be managed similarly to the PSME-MCN/LIDEE/IRI type. Competition from both bearclover and tanoak can be high, requiring intensive management to ensure sufficient regeneration for timber management. Suitable reforestation species are ponderosa pine, Douglas-fir, and sugar pine. Natural regeneration of incense cedar is likely. Deer may use these sites, sometimes for winter range at lower elevations. Young bearclover shoots have higher nutritional value than the older shoots.

PIPO-MCN/ARC-CHFO2

Pinus ponderosa-mixed conifer/Arctostaphylos sp. -Chamaebatia foliolosa

ponderosa pine-mixed conifer/manzanita species-bearclover

Vegetation Summary Table

(Sample size: 13)

		Cover	Cons
Tree Overstory Layer			
PIPO	ponderosa pine	15	100
CADE3	incense cedar	14	100
QUKE	black oak	6	100
Tree Understory Layer			
CADE3	incense cedar	2	100
PIPO	ponderosa pine	2	92
QUKE	black oak	3	69
Shrubs			
ARC	manzanita sp.	44	100
CHFO2	bearclover	15	100
Herbs/Grasses			
ACOCO	western needlegrass	2	85
ERLA6	woolly sunflower	1	85
CHPO1	soap plant	1	46

Environment

Elev: 4700 (3400-5600)

Aspect: S, SW

Slope: 21% (2-40%)

Landfm: ridges, upper slopes

Landscape Ecology and Environment:

The PIPO-MCN/ARC-CHFO2 type is similar and occurs within the same area as the PIPO-MCN/CHFO2/GABO1 type, but on shallow soils with volcanic substrates. Available water holding capacities are very low and surface rock cover is high. This type occupies some of the harshest conifer-occupied sites within the mixed conifer zone, found on hot, dry, south-facing upper slopes or ridges. This type occupies areas of variable size in the landscape, from small to 40 acres. It typically occurs adjacent to or intermixed with the PIPO-MCN/CHFO2/GABO1 type.

Vegetation:

Late seral stands have very open conifer overstories and well developed shrub layers of manzanita and bearclover. Ponderosa pine dominates the overstory and regeneration layers or co-dominates with incense cedar. Black oak is usually present in low amounts. Sugar pine, Douglas-fir, and white fir rarely occur. This type is often a woodland rather than a forest, with overstory tree covers typically between 10 and 40%.

A mix of whiteleaf or greenleaf manzanita typically dominates an often dense shrub layer, indicating dry, sunny conditions. On most sites, the occurrence of manzanita is related primarily to disturbance; in this type, however, it indicates shallow, rocky soils and will persist in later seral stages due to the open tree canopies that are characteristic. The distribution of bearclover and manzanita are variable, but often bearclover occurs only under the shade of manzanita, indicating very harsh growing conditions for plants. The herb and grass layers are variable, depending on the shrub cover. Typical dry site indicators are western needlegrass, woolly sunflower, and soap plant. Some sites support diverse annual herb assemblages including *Lotus* spp., *Navarretia* spp., lupine, and naked-stemmed buckwheat.

Fire Ecology:

The natural fire regime for this type is likely frequent, low intensity to medium intensity fires. The topographic position and aspect suggest frequent low intensity fires, but the high temperatures created by burning manzanita suggests that medium intensity fires would also have been likely.

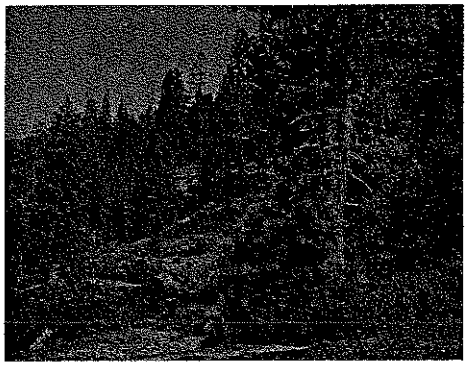
Productivity and Management:

Productivity and stocking are very low and sites are not suitable for timber management. Protection of soil cover and depth is critical for maintenance of long-term productivity and roots are important in holding soils in place. Management of sites adjacent to this type should take into consideration the overland water flow that can occur across this type. The open tree canopies with manzanita provide foraging habitat for bear and deer. Red tail hawks use these sites for hunting rodents. Prescribed burning for wildlife habitat can be effective with small patch fires. The sensitive plants, Pleasant Valley Mariposa lily and yellow bur navarretia, occur in this type.

PIPO-MCN/QUCHN-QUVA

Pinus ponderosa-mixed conifer/Quercus chrysolepis var nana-Quercus vaccinifolia

ponderosa pine-mixed conifer/shrubby canyon live oak-huckleberry oak



Vegetation Summary Table

(Sample size: 7)

		Cover	Cons
Tree Overstory Layer			
CADE3	incense cedar	17	100
ABCO	white fir	9	100
PIJE	Jeffery pine	10	86
QUKE	black oak	8	86
PILA	sugar pine	4	71
PIPO	ponderosa pine	20	14
Tree Understory Layer			
ABCO	white fir	1	71
PIJE	Jeffrey pine	4	57
CADE3	incense cedar	1	57
PILA	sugar pine	1	57
Shrubs			
QUVA	huckleberry oak	20	100
QUCHN	shrubby canyon live oak	10	14
Herbs/Grasses			
ERUM	sulphur buckwheat	2	57
ERNU3	naked-stemmed buckwheat	1	43
CAUM2	pussypaws	1	43

Environment

Elev: 5400

Aspect: W, S, SW

Slope: 23% (8-35%)

Landfm: lower slopes

Special: Often has Native American mortar sites.

Landscape Ecology and Environment:

This type indicates dry, open sites, with extensive granite rock outcrops. Sites are typically variable in aspect, occurring on lower slopes. Trees and shrubs occupy pockets of soil amidst the rock outcrops. It occupies small to moderately large areas in the landscape. At higher elevations it intergrades with the closely related PIJE/QUVA types. This type was mapped extensively on the Placerville Ranger District, and data from map notes are used here for a preliminary description of the type. It likely occurs on other sites in canyons or drainages with granite outcrops.

Vegetation:

Late seral forest are characterized by an open conifer woodland of stunted or mid-sized trees and a scattered shrub layer dominated by huckleberry oak. The conifer overstory is composed of varied mixtures of incense cedar, ponderosa pine, and Jeffrey pine, and occasionally sugar pine, Douglas-fir, or white fir. Few layers occur. Conifer regeneration is dominated by ponderosa pine and incense cedar. Black oak may occur in low amounts.

The shrubby canyon live oak or possibly huckleberry oak dominates the scattered shrub layer. The herb layer is often diverse, including sunny, very dry site indicators. Sulphur buckwheat, naked-stemmed buckwheat, mountain jewel flower, gray lupine, and pussypaws are the most prevalent herbs.

Fire Ecology:

These sites are dominated by rock outcrops, with little or no fuel accumulation and no fuel ladders. It is likely that under a natural regime, fires did not spread very far in these sites and that they acted as natural fuel breaks.

Productivity and Management:

This type is not suitable for vegetation management because tree and shrub cover is very limited, occurring primarily in rock fractures or small pockets of alluvial soils. Runoff of water into adjacent managed areas is a concern, with overland flow typical. This type forms a good natural fuel break.

The open woodland with its resident rodent population, provides foraging habitat for great-horned owl or red-tailed hawk. This type is not suitable for wildlife travel corridors due to the lack of cover.

Many Native American mortar and pestle sites have been found in this type.

PIPO-MCN/ANRO-ERNU3

Pinus ponderosa-mixed conifer/Antennaria rosea-Eriogonum nudum ponderosa pine-mixed conifer/rosy everlasting-naked-stemmed buckwheat

Vegetation Summary Table

(Sample size: 7)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	33	100
ABCO	white fir	25	100
PIPO	ponderosa pine	24	86
CADE3	incense cedar	8	86
PIJE	Jeffrey pine	9	57
Tree Understory Layer			
PSME	Douglas-fir	2	100
ABCO	white fir	2	100
CADE3	incense cedar	1	86
PIPO	ponderosa pine	1	57
PIJE	Jeffrey pine	1	29
Shrubs			
SYMO	cr. snowberry	1	57
Herbs/Grasses			
HIAL	hawkweed	1	100
ANRO	rosy everlasting	1	71
ERNU3	naked-stem buckwheat	1	42

Environment

Elev: 5100 (4900-5300)

Aspect: E, W, NE, SW

Slope: 48% (38-60%)

Landfm: mid-slope

PASI: 224 (137-294)

Site Class: 1 (1-2)

Landscape Ecology and Environment:

This type indicates dry sites with low precipitation. Sites are east or west-facing, moderately steep to steep, midslopes on granitic substrates. Solar insolation is high. Soils are moderately deep, with low to moderate A.W.C.'s.

Vegetation:

Late seral forests are characterized by an open conifer overstory and a sparse herb layer that includes rosy everlasting or naked-stemmed buckwheat. Douglas-fir and ponderosa or Jeffrey pine co-dominate the overstory. White fir and incense cedar are minor associates in the tallest overstory but are common in the midstory. Regeneration is dominated by low amounts of white fir, Douglas-fir, and incense-cedar. This is one of the few types where ponderosa or Jeffrey pine regeneration was present in almost all the plots. The pine regeneration indicates dry sites and open canopies.

The shrub layer is variable with disturbance indicators such as tobacco brush, greenleaf manzanita, and squawcarpet most prevalent, and scattered creeping snowberry. Scattered dry, sunny site indicators include rosy everlasting, yarrow, naked-stemmed buckwheat, and squirreltail.

Fire Ecology:

The geographic location (eastside) and topographic position of this type, east or west facing midslopes, suggest a natural fire regime of frequent, low intensity fires, perhaps with variable spread. This suggested regime is well supported by the observations of fire scarred trees, charred bark, or charred logs in every plot.

Productivity and Management:

Timber productivity is moderate, with moderate site class and moderate to low stocking, due to the low precipitation for mixed conifer sites and low soil A.W.C.'s. These soils, developed from decomposed granite, are susceptible to erosion and long-term productivity losses from organic material loss. Maintenance of organic material and soil cover are critical for nutrient cycling and long-term productivity. Maintenance of partial stocking at all times is recommended to avoid volatization of litter cover in hot openings. Jeffrey pine, ponderosa pine, and Douglas-fir are suitable reforestation species. With fire suppression, white fir will dominate regeneration, resulting in forest health problems with periodic, widespread drought-induced mortality due to low precipitation and A.W.C.'s. Dwarf mistletoe can be heavy on ponderosa or Jeffrey pine. Current stands (with fire suppression history) have dense canopies with little or no understory; they can provide thermal cover for deer, but no forage. These stands could provide marginal spotted owl habitat if fire suppression maintains the dense stocking. Under a natural fire regime of frequent low intensity fires, or other vegetation management to open the stands up, tobacco brush and manzanita would provide forage for deer and other wildlife.

PSME-MCN/QUVA
Pseudotsuga menziesii-mixed conifer/Quercus vaccinifolia
Douglas-fir-mixed conifer/huckleberry oak

Vegetation Summary Table
(Sample size: 6)

		Cover	Cons
Tree Overstory Layer			
PSME	Douglas-fir	40	100
ABCO	white fir	23	100
PILA	sugar pine	13	100
CADE3	incense cedar	11	66
PIPO	ponderosa pine	19	33
Tree Understory Layer			
ABCO	white fir	7	100
PSME	Douglas-fir	1	100
CADE3	incense cedar	2	83
PILA	sugar pine	1	83
QUKE	black oak	1	83
PIPO	ponderosa pine	1	33
Shrubs			
QUVA	huckleberry oak	18	100
SYMO	creeping snowberry	5	83
Herbs/Grasses			
CHUM	w.prince's pine	10	83
HIAL	white-flw. hawkweed	2	83
CAMU1	multi-stemmed sedge	1	83
GABO1	Bolander's bedstraw	1	83
CAPR6	Cal. harebell	2	67

Environment

Elev: 4900 (4500-5300)
Aspect: NW, E
Slope: 56% (45-64%)
Landfm: upper slopes

PASI: 206 (154-274)
Site Class: 2 (2-4)
FSSC 4 (3-5)

Landscape Ecology and Environment: This type indicates open, often dry sites, with shallow soils on metamorphic substrates. Sites are northeast or southeast facing, steep, upper slopes. Soils are mostly shallow, with low available waterholding capacities. This type occupies small to medium sized areas in the landscape. It often occurs in a mosaic with the PSME-MCN/AMUT type.

Vegetation:

Late seral forests are characterized by an open conifer forest and a patchy shrub layer dominated by huckleberry oak. Douglas-fir dominates or co-dominates the conifer overstory. Incense cedar and sugar pine are consistent minor components. White fir occurs in varying amounts in the overstory or in the midstory. Ponderosa pine is a major component or co-dominant on some sites. Conifer regeneration is dominated by white fir, but Douglas-fir and incense cedar are consistently present in low amounts. Black oak is occasionally present in the overstory, but is always found in the regeneration layer in low amounts.

Huckleberry oak dominates the patchy shrub layer, although the cover varies. Huckleberry oak indicates sites with shallow or rocky soils. The herb layer is diverse, with dry, open site indicators most prevalent. Typical species are white flowered hawkweed, Bolander's bedstraw, *Silene* species, multi-stemmed sedge, and fan violet. Sometimes moist site herbs are present, indicating sites that are adjacent to moist areas.

Fire Ecology:

Aspects are varied in this type, resulting in different possible natural fire regimes. However, all sites are on steep, upper slopes, suggesting a natural fire regime of frequent, low intensity fires. Localized areas of more intense fires may occur due to the steep slopes, but fuel loading and ladders are usually low.

Productivity and Management:

Low timber productivity and shallow, sensitive soils make these sites suitable for limited light vegetation management. Site classes are high where individual trees are growing in fractures in the bedrock or in small pockets of deeper soil, but stocking is very low. Forest development and recovery take a long time in limited soils. Retention of organic material (litter and logs) are critical to maintain long-term productivity on these soils. Erosion hazard is high, with gully erosion likely. Any limited management should emphasize natural regeneration, since artificial regeneration is not reliable. Mistletoe can be a severe problem. The open canopies of this type can provide some foraging for spotted owls. Deer may use sites for foraging or transitional range, especially when black oak is present. Huckleberry oak acorns provide forage for deer and rodents. The sensitive plants, Quincy lupine and Tracy's sanicle, may occur in this type.

ABCO-MCN/ACCI-CHSE2

Abies concolor-mixed conifer/Acer circinatum-Chrysolepis sempervirens
white fir-mixed conifer/vine maple-bush chinquapin

Vegetation Summary Table

(Sample size: 6)

		Cover	Cons
Tree Overstory Layer			
ABCO	white fir	61	100
PSME	Douglas-fir	34	100
PILA	sugar pine	26	100
CONU2	dogwood	10	67
Tree Understory Layer			
CONU2	dogwood	10	100
ABCO	white fir	4	100
PSME	Douglas-fir	2	83
CADE3	incense cedar	2	67
PILA	sugar pine	2	50
Shrubs			
CHSE2	b. chinquapin	21	100
ACCI	vine maple	15	100
ROGY	wood rose	2	100
AMPA2	serviceberry	2	83
PAMY	Oregon boxwood	1	83
Herbs/Grasses			
CHUM	w. prince's pine	2	100
PYPI	w.-veined wintergreen	1	100
SMRA	solomon's seal	1	50

Environment

Elev: 4700 (4600-4800)

Aspect: N, NE, NW

Slope: 49% (32-68%)

Landfm: lower slopes

PASI: 203 (168-267)

Site Class: 1 (1-2)

FSSC 2 (2-3)

Landscape Ecology and Environment:

This association indicates cool sites on rhyolite or andesite substrates with subsurface water flow. Sites are north, northwest, or northeast-facing, moderately steep, lower slopes. Soils are moderately deep to deep with high A.W.C.'s. It occupies small areas in the landscape.

Vegetation:

Late seral forests are characterized by a moderately dense conifer overstory, and vine maple and bush chinquapin in the shrub layer. Douglas-fir and sugar pine dominate the overstory. White fir occurs with high cover, but is most prevalent in the midstory and mid-level overstory. Red fir, ponderosa pine,and mountain dogwood may occur but in low amounts. White fir dominates the regeneration layer, but Douglas-fir and incense cedar are prevalent in low amounts.

The well developed shrub layer is co-dominated by vine maple and bush chinquapin. Wood rose and thimbleberry are consistent minor associates. Herbs are sparse and low in cover beneath the dense shrub layer. Prevalent species are western prince's pine, dogbane, and false Solomon's seal.

Fire Ecology:

The topographic position, north-facing lower slopes, and moist conditions indicate that a natural fire regime includes moderately infrequent, low intensity, uneven spreading fires.

Productivity and Management:

Timber and shrub productivity are high in this type, with high site class and stocking. The high productivity is a result of high water table and subsurface water flow and, therefore, this type is sensitive to intensive management. These sites are often in or adjacent to riparian zones; soils tend to be highly erodible and mass wasting is likely on steeper slopes. Site specific evaluation of hydrologic conditions should be made before intensive managment is planned. Road building may create seeps at road cuts. Suitable reforestation species are Douglas-fir, white fir, and sugar pine. Competition from bush chinquapin and especially vine maple can be heavy. Several pathogens are likely due to the moist conditions, including *Armillaria*, quinine fungus, and red-brown butt rot. This type provides high quality habitat for late seral dependent species including spotted owls, marten and fisher. It is also highly suitable for neotropical birds, especially when adjacent to riparian areas. Amphibians may occur here or nearby due to the moist conditions. The sensitive plant, Salmon Mountain wakerobin, may occur in this type. Minimal forage for domestic livestock may occur in adjacent riparian areas, but these are sensitive to trampling.

ABCO-MCN/ALTE/CAREX
Abies concolor-mixed conifer/Alnus tenuifolia/Carex sp.
white fir-mixed conifer/mountain alder/sedge

This riparian plant association occurs along large streams or rivers at higher elevations in the mixed conifer zone. A conifer overstory of a mixture of white fir, incense cedar and sometimes Douglas-fir above a dense layer of mountain alder typify this plant association. Several wet site sedge species typically occur in patches in the understory.

ABCO-MCN/ALTE/ACCO
Abies concolor-mixed conifer/Alnus tenuifolia/Aconitum columbianum
white fir-mixed conifer/mountain alder/monkshood

This uncommon type occurs in local areas where seeps or springs are located. An unusual combination of a lower montane mixed conifer overstory and a shrub layer of mountain alder typify this community. A diverse assemblage of tall, wet site indicator herbs dominate a dense meadow-like understory. Twenty-eight herb and grass species were identified in the sample location on the Beckworth Ranger District. Species include monkshood, horsetail, leopard lily, swamp onion, arrowleaf senecio, Sierra rein orchid, broad-lipped twayblade, colombine, lady fern, fireweed, and cone flower.

PSME-MCN-ALRH/DAPE
Psuedotsuga menziesii-mixed conifer-Alnus rhombifolia/Darmera peltata
Douglas-fir -mixed conifer/white alder/Indian rhubarb

This plant association occurs extensively along major streams and rivers throughout the lower and mid-elevations of the mixed conifer zone. A conifer overstory and white alder midstory, with Indian rhubarb in the understory are characteristic. Douglas-fir usually dominates the overstory, with incense cedar and white fir as common minor components. Sugar pine or ponderosa pine is occasionally present. Indian rhubarb is restricted to the edge or immersion in running water.

PSME-MCN/COST3
Psuedotsuga menziesii-mixed conifer/Cornus sericea ssp. sericea
Douglas-fir -mixed conifer/American dogwood

This minor riparian association occurs adjacent to large streams or rivers. A mixed conifer overstory and low midstory or tall shrub layer of American dogwood and California mountain ash are typical. Several other shrubs may occur including mountain alder, serviceberry and mountain maple.

PSME-MCN/LEDA
Psuedotsuga menziesii-mixed conifer/Leucothoe davisiae
Douglas-fir -mixed conifer/Sierra laurel

The PSME-MCN/LEDA association is an uncommon mixture of lower montane tree species and upper montane Sierra laurel. One plot was sampled in the type on the Placerville Ranger District. The association occurs at meadow edges or adjacent to small streams. A mixed conifer overstory of Douglas-fir, white fir and incense cedar over a dense shrub layer of Sierra laurel is characteristic. Dogwood may occur in low amounts.

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